APPENDIX J

Environmental Benefits Analysis (CHAP) Summary and Model Outputs

DRAFT

San Francisco South Bay Shoreline Project Area

San Francisco South Bay Shoreline Wildlife Habitat Assessment Baseline Condition Report

for
U.S. Army Corps of Engineers
San Francisco District

by
Northwest Habitat Institute

May 4, 2012

DRAFT
San Francisco South Bay Shoreline
Wildlife Habitat Assessment

Introduction

Throughout the United States there is a move towards assessing restoration and other conservation activities at the ecosystem level. Under current U.S. Army Corps of Engineers (Corps or USACE) authority, the objective of Civil Works ecosystem restoration is to restore significant ecosystem structure, function, and dynamic processes that have been degraded to a less degraded, more natural condition. Even partial restoration may provide significant and valuable improvements to degraded ecological resources.

Ecosystem restoration projects should examine the needs for improving or re-establishing both the structural components and the functions of the natural system. Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of successful restoration would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention. Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for Corps involvement.

The information used in formulating, evaluating and selecting ecosystem restoration alternatives in Corps Civil Works projects includes both quantitative and qualitative information about outputs, costs, significance, acceptability, completeness, effectiveness, and reasonableness of costs. Within the USACE ecosystem restoration policy, *"An ecosystem restoration proposal must be justified on the basis of its contribution to restoring the structure or function, or both, of a degraded ecosystem, when considering the cost of the proposal. Ecosystem restoration projects are justified through a determination that the combined monetary and non-monetary benefits of the project are greater than its monetary and non-monetary costs. As such, plan selection is not based on economic justification in terms of a traditional monetary benefit to cost analysis, since the majority of benefits associated with the primary outputs of ecosystem restoration can rarely be quantified in dollars. Therefore, ecosystem restoration proposals need not have either a benefit-cost ratio greater than 1.0, or positive net economic benefits. However, any monetary incidental benefits which are anticipated from proposed ecosystem restoration projects, and relevant to the particular circumstances associated with the study, should be displayed to aide in decision making"* (USACE, EP 1165-2-502, 1999).

Instead of calculating economic benefits in monetary terms, Corps ecosystem restoration projects calculate the value and benefits of habitat using established habitat assessment methodologies. Evaluating habitat quality is the approach most often taken to compare ecosystem restoration alternatives because habitat is thought of as a surrogate for ecosystems; it is the setting where plants and animals live, interact, and reproduce. Habitat is frequently viewed in conjunction with species information to gain insight to various uses, structures, and functions existing within

a landscape or site. Determining habitat structure and functional integrity of an area is supportive of an ecosystem management approach.

Habitat Units (HUs) are one of the currencies the Corps currently uses to rate and compare the value of one ecosystem restoration alternative to another. The concept of HUs is derived from the U.S. Fish and Wildlife Service's (USFWS) single species habitat assessment methodology known as Habitat Evaluation Procedures or HEP (1980), which the Corps previously used as a habitat evaluation tool.

Currently, an ecosystem based habitat evaluation framework exists known as HAB or the Habitat Accounting and Appraisal methodology. This approach involves a triad assessment of habitat, species, and functions (O'Neil et al., 2005), and can provide assessments at multiple scales. The Combined Habitat Assessment Protocols (CHAP) method, which incorporates the HAB calculation, generates habitat units (HUs) based on an assessment of multiple species (all potential species at a site), habitat features, and functions by habitat type.

The overall goal of the San Francisco (SF) South Bay Shoreline Ecosystem Restoration project assessment was to evaluate baseline habitat conditions at a fine level of resolution within an ecosystem context. An ecosystem context is more holistic than assessing just a few individual species (Perkins, 2002), especially with federal or stated listed taxa; it calls for a multiple species framework that includes an evaluation of ecological functions. Additionally, the Corps would like to assess alternative scenarios; hence a realistic depiction of actual habitat site conditions at a fine scale level was needed. The approach reported herein depicts the wildlife habitat baseline conditions at a fine resolution or site level-scale, uses multiple species and their habitat functions in its evaluation, and accounts for actual habitat types, structural conditions, and key environmental correlates within the SF South Bay Shoreline project assessment boundary based on input from knowledgeable field staff, inventories, and past studies of the area's habitat components.

Goal:
The primary goal of this feasibility study is to determine the best solution under Corps criteria for provision of tidal flood control and/or ecosystem restoration in the study area, considering existing plans and projects such as the South Bay Salt Pond Restoration Project and the new recovery plans for listed species in the South Bay. Partners in this study include the U.S. Fish and Wildlife Service (FWS), the California State Coastal Conservancy (CSCC, non-federal sponsor), and the Santa Clara Valley Water District (SCVWD, non-federal sponsor).

Study Site
The SF South Bay Shoreline Study (Shoreline Study) is examining the feasibility of flood damage reduction and ecosystem restoration along a portion of the south shoreline of San Francisco Bay (http://www.southbayshoreline.org/); also see Figure 1. The study has been rescoped to about 6,800 acres (3,480 hectacres) that cover the area between the Guadalupe River and Coyote Creek, also known as Economic Impact Area (EIA) 11. This area includes the community of Alviso, California (which is incorporated into San Jose, California), the San Jose-Santa Clara Water Pollution Control Plant (WPCP), and adjacent salt ponds formerly used as part of Cargill, Inc.'s salt production system.

The baseline condition assessment encompasses the area known as ponds A9 through A16, A18, and adjacent areas (see Figure 2). Ponds A17 will be reconfigured by the Don Edwards San Francisco Bay Wildlife Refuge as part of the without-project condition (no action alternative) and will not be part of this study. Pond A18 is being studied by the City of San Jose as part of the reconfiguration of its wastewater treatment plant, but will also be considered by this study.

Background:
The Alviso ponds were formerly part of the Cargill, Inc. solar salt production system, but were sold to the federal government in 2003. The Alviso ponds are now managed by the FWS as part of the Don Edwards San Francisco Bay National Wildlife Refuge. Current management of these ponds primarily favors various species of migratory shorebirds and waterfowl. The ponds are intermingled with sloughs and remnant tidal marshes which are habitat for listed species such as the California clapper rail and the salt marsh harvest mouse, and which provide other important ecological services.

The existing pond levees are not engineered structures. The lands behind them are low-lying and in some cases well below sea level. These lands include the community of Alviso, the New Chicago Marsh, and the San Jose/Santa Clara WPCP. These areas are vulnerable to tidal flooding if the perimeter pond levees fail.

The former salt ponds offer considerable potential for management of shorebirds and waterfowl or for restoration to tidal habitats including marshes. Tidal marsh restoration is expected to be an important measure in assisting the recovery of several endangered species found in the study area such as the salt marsh harvest mouse and the California clapper rail. However, the ponds are currently valuable habitat for many species of shorebirds, waterfowl, and other water birds.

Quantification of habitat restoration benefits will begin with the development of a baseline condition assessment and an assessment of a without project condition for 50 years or what is considered the “no action” alternative. These assessments will then be compared to various alternative scenarios to determine the overall cost-effectiveness of habitat restoration in a national context, to determine optimum outcomes for the two restoration increments of Ponds A9-A16 and Pond A18, respectively.

Evaluation of project benefits and impacts will be quantified for a period of 50 years from the start of construction which is assumed to be 2017. Limited qualitative evaluation of projected effects after these 50 years will be conducted by others and is not part of this contract.

Figure 1. Regional context for Shoreline Study area location (source map from the South Bay Salt Pond Restoration Project).

Figure 2. A local view of the Shoreline Study area general project boundary delineation along with pond polygon identification numbers.

Methods

The CHAP approach uses a triad assessment of habitat, species, and functions, to depict its results visually using a series of maps. To begin the process, a list of wildlife species for the project was obtained. The initial Habitat Evaluation Team meeting revealed that USFWS staff that residing or working at the Don Edwards National Wildlife Refuge as a valuable source for wildlife information. The Habitat Evaluation Team established that point of contact would be Cheryl Strong from the USFWS. Ms. Strong was able to generate a species list (for both fish and wildlife) working either by herself, with colleagues or through her contacts of knowledgeable people for baseline conditions, alternatives and without project conditions. Northwest Habitat Institute (NHI) was able to generate an initial species list for the project by accessing the California Wildlife Habitat Relationships (CWHR) geographic information system (GIS). A query of the site's potential species was done by accessing the peer reviewed wildlife species range maps that overlapped with the project boundary. Additionally, Ms. Strong from the USFWS was also able to review the NHI generated potential species list, as well as develop specific bird lists for each pond along with determining their presence during the four seasons.

Next, we needed to associate the species list with habitat types, which required a several step process.

First, it was necessary to develop a list of wildlife habitat types located within the South Bay Shoreline project boundary by polygon. There have been and are currently a number of studies whereby several habitat classification have been used. Additionally, there is a strong desire by the Habitat Evaluation Team to use this existing information for this project. NHI was able to work with the project partners, specifically USFWS, to determine two habitat classification systems that could be cross-walked to the existing information used by CHAP to complete the baseline condition report. One to assess the baseline conditions (Table 1) and the other to evaluate without project conditions over a 50 year period (see Table 9 in 50 Year Future without Project section).

Baseline Conditions
Batch Pond - Bulrush & Sedge Marshes
Brackish Marsh
Developed
Freshwater Marsh
Landfill
Levee
Managed Pond
Tidal Flats/Mudflats
Muted Tidal / Diked Marsh
Open Water/Slough Channel
Parks / Upland Grassland
Riparian/Creek Corridor
Saline Marsh
Seasonal Wetland
Upland Vegetation
Water / Sewage Treatment

Table 1. Habitat classifications used to determine baseline conditions effects.

Because there were a number of past projects that the partners were aware of and wanted to use; habitat types were cross-walked to the above classification. Specific vegetation types and associations were also noted when creating the crosswalk(s) along with the amount of invasive species. Next, the Key Ecological Correlates (KECs) or fine feature elements that may exist within each polygon were identified. Ms. Strong developed a list of common KECs that would be found by habitat type that could be applied to the polygons within the project boundary.

Because CHAP is built around the triad concept of species-habitat-functions, the next step was to update the Northwest Habitat Institutes' Integrated Biodiversity Information System (IBIS) data system[1] (Johnson and O'Neil, 2001) and establish the key ecological functions (KEFs) for each species. For 35 new species that were not already a part of IBIS, this required researching the species and identifying a list of KEFs for inclusion into IBIS.

To reiterate, KECs represent habitat elements (physical and biological) that are thought to most influence a species distribution, abundance, fitness, and viability, while KEFs refer to the principal set of ecological roles performed by each species in its ecosystem. More specifically, KEFs refer to the main ways organisms use, influence, and alter their biotic and abotic environments. The KECs and KEFs are crucial components in determining the wildlife habitat unit values.

A site level-scale approach is used to refine the habitat value calculations for the SF South Bay Shoreline project polygons. The CHAP approach involves four components: 1) preliminary mapping, 2) field inventory, 3) data compilation and analysis, and 4) GIS maps, spreadsheets and report.

1. Preliminary mapping: The Shoreline Study site is refined by identifying and delineating polygons with homogenous habitat types based on visual interpretation of photography or imagery. At the onset, the National Agriculture Imagery Program or NAIP imagery was used but this was later transferred to high-resolution imagery supplied by Army Corp of Engineers.

2. Field inventory: This CHAP analysis used existing field inventory data generated by the project partners.

3. Data compilation and analysis: Data from the field inventory is used to generate a habitat value for each polygon within the study site. The species list developed for the project area was reviewed by the knowledgeable field staff Additionally, the list of taxa is merged with the KEC and KEF fields within the IBIS data sets to allow the creation of two matrices for each polygon: species by functions and habitat by functions. These matrices are then summed and multiplied by the acreage of the polygon to calculate HUs for each polygon.

4. GIS maps, spreadsheets, and report: GIS maps are generated that depict the habitat values (HUs) of each polygon. Supporting maps illustrate: a) project or area boundaries; b) polygon numbering; c) corrected habitat value per acre; d) habitat units; e) amounts of non-native plant species by polygon; f) wildlife habitat types by polygon; and g) structural conditions by polygon. Spreadsheets are developed that contain the polygon calculations of the species-functions and habitat-functions matrices, along with an overall site or area habitat value.

[1] The IBIS data system is a peer expert system that contains current ecological information on more than 1,000 fish and wildlife species.

Determining the Habitat Unit Value

To establish a habitat unit value, two matrices are developed. The first matrix determines the species mean functional redundancies (MFRI) based on the species list (Appendix A-1) that was developed and reviewed for the baseline condition of Shoreline Study by habitat class (Appendix A-2). Determining the MFRI is the first step in the computation to determine the baseline habitat condition values [see Appendix B - Matrix Relationships, Matrix 1]. A MFRI is created for each habitat type present within the study area.

The second matrix is usually generated by conducting field inventories by polygon. But because of the number of knowledgeable field staff located at the site and the number of past studies conducted, it was determined that enough data existed to generate this information. By using these resources, a list of Key Environmental Correlates (KECs[2]) was generated for each polygon. Once this was completed, a KEC function matrix by habitat type is created [see Appendix B - Matrix Relationships, Matrix 2]. This matrix represents the habitat components which characterize potential functions within each polygon at the site. Per acre baseline values were then computed for each polygon by adding Matrices 1 and 2 together [species-functional redundancy (MFRI) value and the KEC-functional redundancy value] for each habitat type. Then, the two matrix values are summed to give a per acre value for each polygon.

The per acre value is a stronger indicator of wildlife habitat quality because it represents the innate worth to animal taxa, as determined by accounting for species, habitats, and their functions; and because the influence of polygon size (acres) is removed from consideration. Thus, small polygon areas can be shown to have a high per acre value, conversely large areas may show a low per acre value. Nevertheless, to determine a site's overall baseline HU value, each polygon's per acre value is multiplied by its acreage and then these values are summed across all polygons. This generates an uncorrected HU value because no adjustments have been considered.

Site Location Adjustment Value

Since the SF South Bay Shoreline project area is located near an urban setting, there are several ecosystem drivers and stressors that can affect the baseline condition and how it is currently managed. We identified one major influence that can affect the habitat value potential in each habitat type, invasive plant species. Using the CHAP protocol, allows us to adjust polygon values based on the presence and abundance of invasive plant species, as documented during the field inventory from past projects or based on local knowledge (see Table 2). Additionally, the percent abundance of invasive species by polygon can also be spatially displayed to show their influence on the habitat value.

Subsequently, each polygon is assigned an invasive plant value based on the occurrence of invasive species identified within the polygon. If a vegetation layer is not present, it is left blank and that layer does not calculate into the invasive factor. Because invasive species generally negatively influence ecosystem function, the per acre values were then discounted for the presence of invasive plants, using the values in Table 3; this allows us to arrive at a corrected per acre value for each polygon.

[2] See Appendix B – Matrix 2.

The main invasive species of concern with the project area is Peppergrass (Lepidium spp). Areas containing peppergrass were identified and delineated into GIS polygons by H.T. Harvey & Associates resulting during their 2010 Marsh Study. There were 10 vegetation classes within the Marsh Study that contained peppergrass. Based on conversations with Ron Duke from H.T. Harvey & Associates about how the Marsh Study data was designed and information collected, we were able to assign invasive plant adjustment factors that corresponded with CHAP protocols to each class. The adjustment factors by vegetation class are:

Table 2. Adjustment factor as identified by the 2010 Marsh Study by invasive vegetation class.

Adjustment Factor	Invasive Vegetation Class
0.3	Peppergrass
0.5	Peppergrass/Pickleweed
0.5	Peppergrass/Peripheral Halophytes
0.5	Peppergrass/Alkali Bulrush
0.5	Peppergrass/Upland vegetation
0.7	Pickleweed/Peppergrass
0.7	Peripheral Halophytes/Peppergrass
0.7	Alkali Bulrush/Peppergrass
0.7	Spearscale/Peppergrass
0.7	Alkali Heath/Peppergrass

Cheryl Strong, who works at the Don Edwards US Fish and Wildlife Service refuge, was also able to provide NHI with a list of adjustment factors based on her local knowledge for polygons where she felt familiar enough to make the calls. The remaining polygons were either intersected by the 2010 Marsh Study or were mostly upland or developed areas.

The 2010 Marsh Study GIS shapefile was then overlaid onto the baseline condition polygons to determine proportions of each polygon covered by invasive species. For each polygon, an overall adjustment factor is determined by finding the Table 2 value and then multipling it by the proportion of the polygon that it covers. The sum from these values was then calculated for each polygon. Finally, the proportional values that were summed for each polygon were then grouped into a normalized table (Table 3). For instance, if total of a polygon's invasive scored was .85 then the group class would be .8, which means that a 20% deduction of the polygon total value resulted from the presence of invasive species.

Table 3. Normalizing Invasive adjustment ranges and value.

Determined Invasive Adjustment	Grouped Class
1 - 0.95	1
0.94 - 0.90	0.9
0.89 - 0.80	0.8
0.79 - 0.70	0.7
0.69 - 0.60	0.6
0.59 -0.50	0.5
0.49 - 0.40	0.4

Any areas within the study area that were not intersected by the 2010 Marsh Study or not commented on by Cheryl Strong did not have enough information available to allow us to apply an adjustment value. Approximately 44 polygons fell into the unknown category and are shown in black in Figure 5. These areas may need to be reviewed to determine if a uniform adjustment factor should be applied them or if additional analysis is needed.

Results:

The 173 polygons on the SF South Bay Shoreline site were determined by delineating the various wildlife habitat types that occur within the project area. These include: batch ponds, brackish marsh, developed areas, freshwater marsh, landfill, levee, managed pond, mudflats, muted tidal/diked marsh, open water, parks/upland grassland, riparian creek corridor, saline marsh, seasonal wetland, upland vegetation and water sewage treatment (see Table 4). In total these polygons account for about 6,674 acres (or 2,700 ha). A complete breakout of the habitat units per polygon can be found in Table 5 while a breakdown of just the ponds by seasonal bird use can be found in Table 6. Figures 2 thru 7 further illustrate the various habitats and habitat units by acreage; spatial depiction of habitat types, amount of invasives, per acre value and number of habitat units by polygon.

Table 4. Shoreline Study Areas breakout of acreage of habitat type.

Batch Pond	Brackish Marsh	Developed	Freshwater Marsh	Landfill	Levee	Managed Pond	Mudflat
825.74	328.37	573.66	119.49	67.32	197.53	2297.93	220.5
Muted Tidal / Diked Marsh	Open Water	Parks / Upland Grassland	Riparian/ Creek Corridor	Saline Marsh	Seasonal Wetland	Upland Vegetation	Water / Sewage Treatment
545.47	349.74	251.91	14.23	413.13	33.65	26.14	409.13

Table 5. Acreage and Habitat Value (HUs) for each of the CHAP habitat evaluation polygons.

Polygon ID	Acres	Habitat Type	Habitat Units	Polygon ID	Acres	Habitat Type	Habitat Units
SB_001	1.58	Developed	7.22	SB_033	0.51	Open Water	15.14
SB_002	1.59	Levee	27.8	SB_034	0.39	Open Water	11.63
SB_003	6.95	Upland Vegetation	110.55	SB_035	0.26	Open Water	7.7
SB_004	4.87	Upland Vegetation	86.1	SB_036	29.28	Seasonal Wetland	330.37
SB_005	2.79	Freshwater Marsh	70.95	SB_037	1	Muted Tidal / Diked Marsh	15.24
SB_006	1.2	Upland Vegetation	21.18	SB_038	0.66	Muted Tidal / Diked Marsh	10.13
SB_007	0.81	Open Water	23.99	SB_039	0.21	Levee	3.67
SB_008	0.14	Open Water	3.85	SB_040	85.39	Levee	1493.51
SB_009	1.57	Levee	27.47	SB_041	62.73	Mudflat	1013.55
SB_010	0.58	Upland Vegetation	10.29	SB_042	6.17	Mudflat	79.77
SB_011	0.68	Saline Marsh	4.56	SB_043	3.82	Mudflat	61.79
SB_012	0.77	Upland Vegetation	13.55	SB_044	0.76	Open Water	20.29
SB_013	0.9	Saline Marsh	7.53	SB_045	1.83	Seasonal Wetland	20.62
SB_014	4.8	Levee	83.88	SB_046	2.27	Levee	31.79
SB_015	8.64	Mudflat	139.62	SB_047	22.88	Levee	400.21
SB_016	4.57	Mudflat	51.74	SB_048	11.15	Levee	194.95
SB_017	2.03	Mudflat	32.73	SB_049	0.54	Open Water	16.12
SB_018	1.72	Mudflat	25.05	SB_050	0.95	Freshwater Marsh	24.12
SB_019	0.42	Levee	7.37	SB_051	15.37	Saline Marsh	231.34
SB_020	0.25	Levee	4.37	SB_052	41.38	Saline Marsh	692.17
SB_021	0.17	Levee	3	SB_053	11.4	Saline Marsh	152.55
SB_022	0.12	Levee	2.17	SB_054	8.39	Saline Marsh	126.29
SB_023	13.79	Levee	241.13	SB_055	15.01	Saline Marsh	200.9
SB_024	8.29	Developed	37.98	SB_056	0.27	Saline Marsh	4.48
SB_025	3.41	Upland Vegetation	60.34	SB_057	4.67	Saline Marsh	78.17
SB_026	1.07	Freshwater Marsh	27.26	SB_058	0.2	Saline Marsh	3.29
SB_027	12.09	Riparian/Corridor	270.34	SB_059	59.18	Saline Marsh	989.88
SB_028	2.14	Riparian/Corridor	47.89	SB_060	1.23	Saline Marsh	20.65
SB_029	14.65	Managed Pond	319.21	SB_061	7.12	Saline Marsh	119.12
SB_030	6.07	Developed	27.8	SB_062	2.17	Saline Marsh	36.29
SB_031	2.54	Seasonal Wetland	28.65	SB_063	7.08	Saline Marsh	118.41

SB_032	3.49	Open Water	103.67	SB_064	33.2	Saline Marsh	499.82
Polygon ID	**Acres**	**Habitat Type**	**Habitat Units**	**Polygon ID**	**Acres**	**Habitat Type**	**Habitat Units**
SB_065	13.49	Saline Marsh	180.49	SB_100	16.81	Saline Marsh	281.22
SB_069	0.47	Upland Vegetation	8.28	SB_101	0.25	Upland Vegetation	4.33
SB_070	0.16	Upland Vegetation	2.77	SB_066	80.58	Saline Marsh	1213.13
SB_071	0.03	Upland Vegetation	0.54	SB_067	14.75	Saline Marsh	222.09
SB_072	0.07	Upland Vegetation	1.18	SB_068	0.34	Upland Vegetation	6.01
SB_073	16.38	Muted Tidal / Diked Marsh	174.75	SB_102	3.49	Freshwater Marsh	88.79
SB_074	0.24	Upland Vegetation	4.23	SB_103	9.72	Freshwater Marsh	247.31
SB_075	0.29	Open Water	8.75	SB_104	15.62	Brackish Marsh	227.48
SB_076	41.87	Brackish Marsh	696.76	SB_105	14.32	Freshwater Marsh	364.26
SB_077	34.88	Brackish Marsh	507.9	SB_106	0.32	Open Water	9.36
SB_078	0.35	Levee	6.07	SB_107	2.28	Freshwater Marsh	57.88
SB_079	0.3	Open Water	8.87	SB_108	3.34	Developed	15.32
SB_080	0.39	Upland Vegetation	6.86	SB_109	5.53	Levee	96.77
SB_081	0.52	Freshwater Marsh	13.2	SB_110	0.58	Open Water	17.08
SB_082	1.65	Freshwater Marsh	42.06	SB_111	6.8	Parks / Upland Grassland	79.99
SB_083	11.16	Freshwater Marsh	255.45	SB_112	13.95	Parks / Upland Grassland	164.23
SB_084	0.19	Upland Vegetation	3.41	SB_113	20.99	Parks / Upland Grassland	247.05
SB_085	0.69	Upland Vegetation	12.17	SB_114	3.3	Parks / Upland Grassland	38.88
SB_086	27.64	Brackish Marsh	344.96	SB_115	27.51	Parks / Upland Grassland	323.78
SB_087	4.04	Brackish Marsh	75.62	SB_116	0.3	Freshwater Marsh	7.75
SB_088	3.98	Saline Marsh	66.65	SB_117	5.9	Open Water	175.33
SB_089	19.26	Brackish Marsh	400.71	SB_118	3.66	Freshwater Marsh	93.03
SB_090	18.81	Saline Marsh	251.66	SB_119	2.84	Freshwater Marsh	72.12
SB_091	0.23	Upland Vegetation	3.99	SB_120	0.38	Freshwater Marsh	9.56
SB_092	29.07	Brackish Marsh	423.22	SB_121	2.29	Freshwater Marsh	58.28
SB_093	3.99	Brackish Marsh	58.08	SB_122	2.55	Levee	44.66
SB_094	2.14	Brackish Marsh	40.06	SB_123	9.45	Levee	165.3
SB_095	10.88	Brackish Marsh	181	SB_124	1.01	Freshwater Marsh	25.73
SB_096	19.39	Open Water	575.87	SB_125	27.87	Brackish Marsh	405.83
SB_097	1.7	Brackish Marsh	35.46	SB_126	13.45	Mudflat	217.32
SB_098	30.55	Freshwater Marsh	777.03	SB_127	117.37	Mudflat	1896.48

SB_099	45.99	Saline Marsh	769.34		SB_128	0.19	Open Water	5.73
Polygon ID	**Acres**	**Habitat Type**	**Habitat Units**		**Polygon ID**	**Acres**	**Habitat Type**	**Habitat Units**
SB_129	4.48	Saline Marsh	44.93		SB_152	9.34	Parks / Upland Grassland	109.98
SB_130	5.99	Saline Marsh	80.22		SB_153	211.03	Developed	967.22
SB_131	75.92	Brackish Marsh	1421.19		SB_154	4.36	Muted Tidal / Diked Marsh	66.41
SB_132	33.49	Brackish Marsh	487.6		SB_155	31.33	Levee	547.95
SB_133	17.5	Freshwater Marsh	444.98		SB_156	6.38	Freshwater Marsh	145.93
SB_134	1.28	Muted Tidal / Diked Marsh	19.44		SB_157	81.9	Parks / Upland Grassland	964.06
SB_135	315.87	Open Water	9379.52		SB_158	174.24	Developed	798.61
SB_136	3.71	Levee	64.97		SB_159	79.88	Developed	366.12
SB_137	6.63	Freshwater Marsh	168.49		SB_160	68.12	Muted Tidal / Diked Marsh	1037.89
SB_138	1.66	Developed	7.6		SB_161	96.98	Water / Sewage Treatment	0
SB_139	0.44	Upland Vegetation	7.81		SB_162	67.32	Landfill	243.16
SB_140	58.81	Developed	269.54		SB_163	20.89	Muted Tidal / Diked Marsh	318.29
SB_141	50.75	Muted Tidal / Diked Marsh	773.25		SB_164	24.14	Muted Tidal / Diked Marsh	367.75
SB_142	28.76	Developed	131.82		SB_A10	249.81	Managed Pond	5442.71
SB_143	312.15	Water / Sewage Treatment	0		SB_A11	261.7	Managed Pond	5701.79
SB_144	72.97	Parks / Upland Grassland	858.89		SB_A12	308.2	Batch Pond	6201.74
SB_145	4.86	Upland Vegetation	85.95		SB_A13	266.65	Batch Pond	5365.61
SB_146	140.53	Muted Tidal / Diked Marsh	2141.15		SB_A14	336.92	Managed Pond	7340.51
SB_147	198.53	Muted Tidal / Diked Marsh	3024.88		SB_A15	250.89	Batch Pond	5048.49
SB_148	6.05	Muted Tidal / Diked Marsh	92.11		SB_A16	242.06	Managed Pond	5273.87
SB_149	11.37	Muted Tidal / Diked Marsh	173.25		SB_A18	826.87	Managed Pond	18015.21
SB_150	1.41	Muted Tidal / Diked Marsh	21.54		SB_A9	365.92	Managed Pond	7972.51
SB_151	15.15	Parks / Upland Grassland	178.35					

Table 6. Habitat Unit value by Pond; determined using only the number of birds species by season**

SITE_ID	Acres	Habitat Units
Spring		
SF_Pond A09	365.92	7,146.4
SF_Pond A10	249.81	4,626.3
SF_Pond A11	261.70	4,937.6
SF_Pond A12	308.20	5,662.5
SF_Pond A13	266.65	4,937.3
SF_Pond A14	336.92	6,563.2
SF_Pond A15	250.89	4,738.6
SF_Pond A16	242.06	4,778.4
SF_Pond A17	130.88	2,583.0
SF_Pond A18	826.87	16,222.3
Total	**3,240**	**62,195.6**

SITE_ID	Acres	Habitat Units
Fall		
SF_Pond A09	365.92	7,678.3
SF_Pond A10	249.81	4,948.0
SF_Pond A11	261.70	4,766.6
SF_Pond A12	308.20	5,757.0
SF_Pond A13	266.65	5,334.2
SF_Pond A14	336.92	6,635.9
SF_Pond A15	250.89	4,963.1
SF_Pond A16	242.06	4,555.4
SF_Pond A17	130.88	2,731.0
SF_Pond A18	826.87	16,002.5
Total	**3,240**	**63,372.0**

SITE_ID	Acres	Habitat Units
Summer		
SF_Pond A09	365.92	6,359.4
SF_Pond A10	249.81	4,196.7
SF_Pond A11	261.70	4,321.4
SF_Pond A12	308.20	5,123.7
SF_Pond A13	266.65	4,219.3
SF_Pond A14	336.92	5,756.5
SF_Pond A15	250.89	4,455.5
SF_Pond A16	242.06	4,587.8
SF_Pond A17	130.88	2,492.3
SF_Pond A18	826.87	14,127.7
Total	**3,240**	**55,640.3**

SITE_ID	Acres	Habitat Units
Winter		
SF_Pond A09	365.92	7,437.2
SF_Pond A10	249.81	4,795.1
SF_Pond A11	261.70	4,799.4
SF_Pond A12	308.20	6,061.6
SF_Pond A13	266.65	5,130.1
SF_Pond A14	336.92	6,769.1
SF_Pond A15	250.89	4,624.6
SF_Pond A16	242.06	4,881.8
SF_Pond A17	130.88	2,538.7
SF_Pond A18	826.87	16,543.9
Total	**3,240**	**63,581.5**

**Total number of species identified by season was: Fall – 77, Winter – 74, Spring – 75, and Summer – 66. (Source: Cheryl Strong, USFWS, who determined the bird species lists by season).

Figure 2. Breakout of baseline acreage by habitat type.

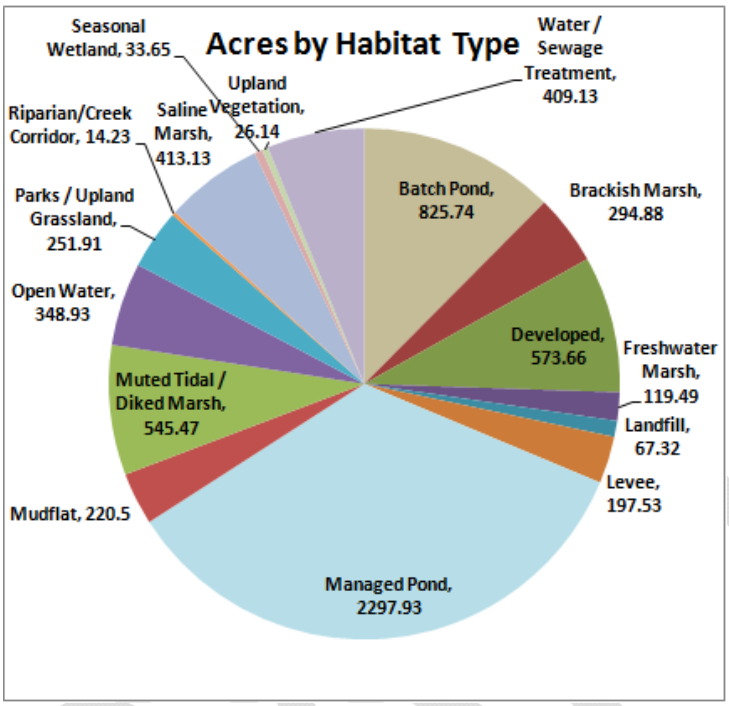


Figure 3. Breakout of the baseline per acre habitat value by habitat type.

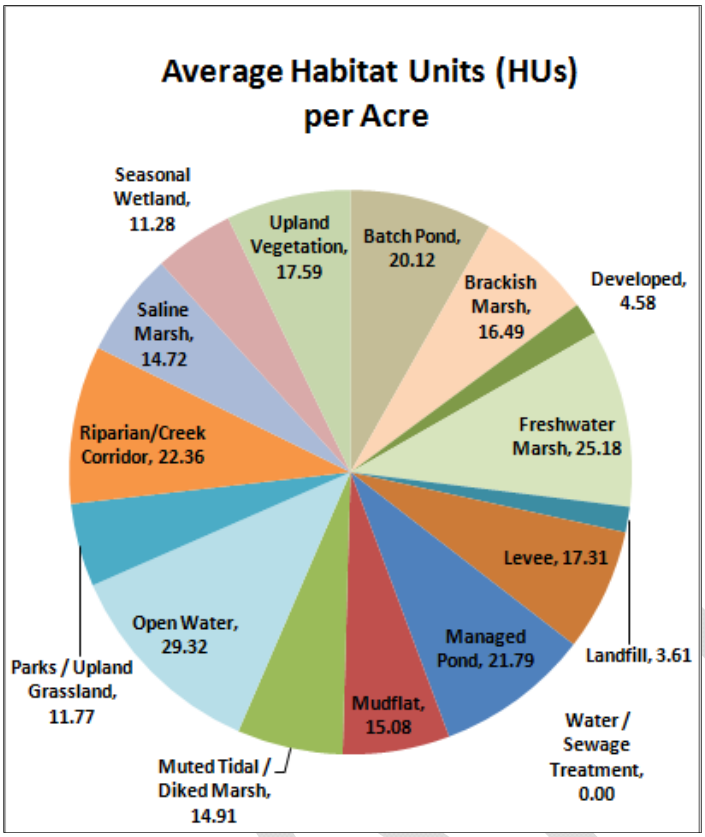

Average Habitat Units (HUs) per Acre
Seasonal Wetland, 11.28
Upland Vegetation, 17.59
Batch Pond, 20.12
Brackish Marsh, 16.49
Developed, 4.58
Saline Marsh, 14.72
Freshwater Marsh, 25.18
Riparian/Creek Corridor, 22.36
Levee, 17.31
Open Water, 29.32
Managed Pond, 21.79
Landfill, 3.61
Parks / Upland Grassland, 11.77
Mudflat, 15.08
Water / Sewage Treatment, 0.00
Muted Tidal / Diked Marsh, 14.91

Figure 4. SF South Bay Shoreline habitat assessment area showing the break out of polygons classified into the Wildlife Habitat Types.

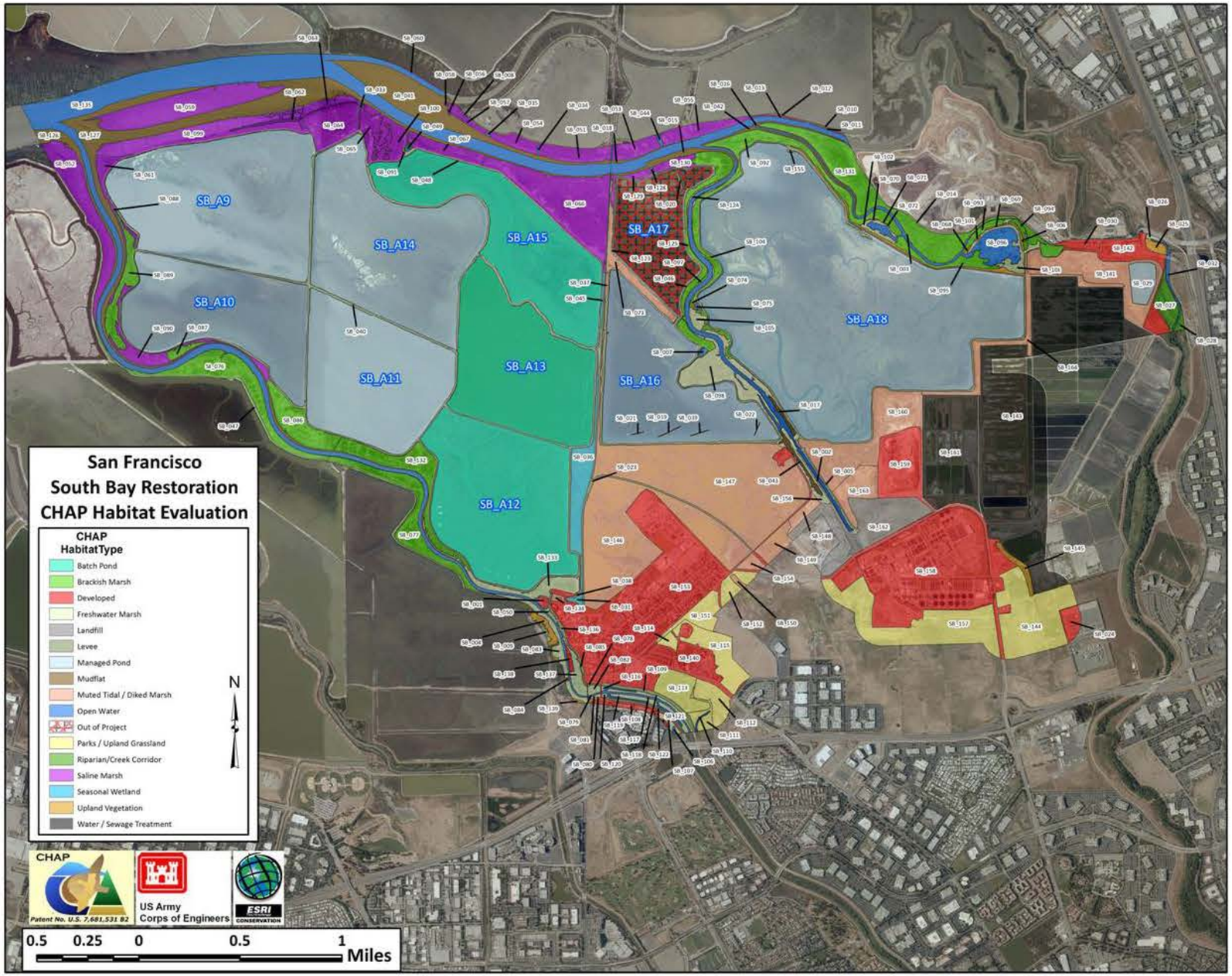


Figure 5. Depiction of the amount of invasive discounting by polygon used in calculating habitat value within the SF South Bay Shoreline project boundary.

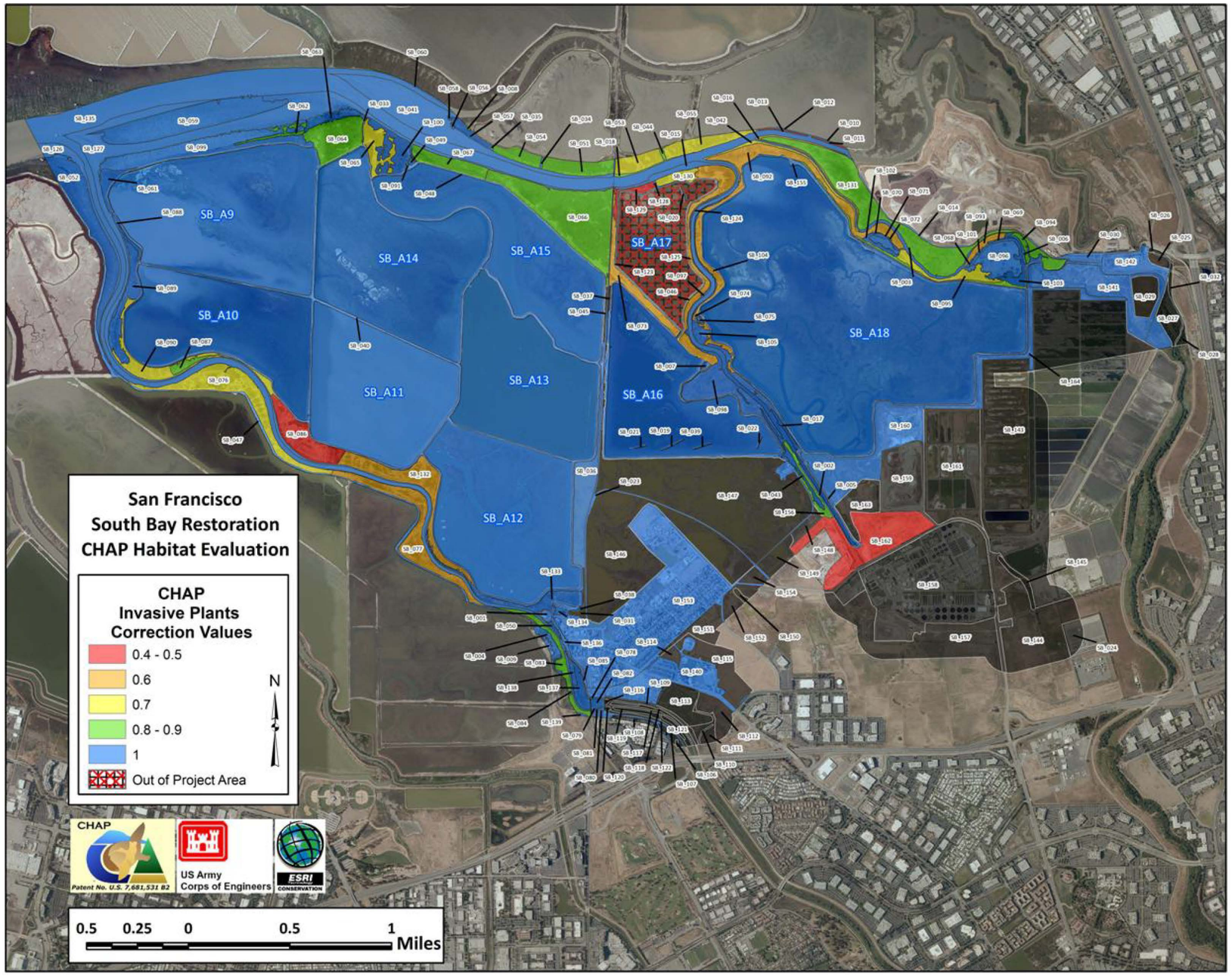


Figure 6. Illustrates the per acre values for each polygon identified at SF South Bay Shoreline project.

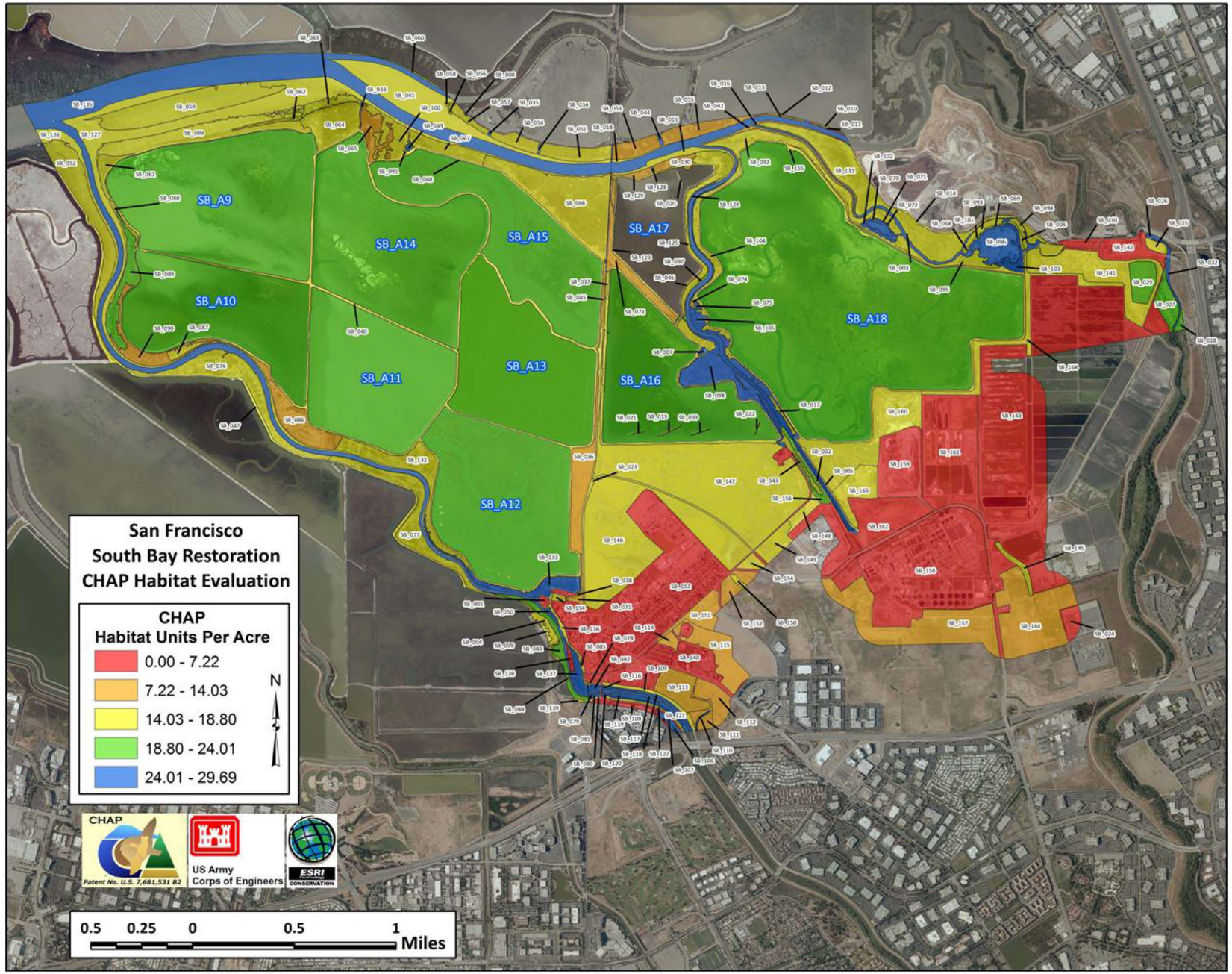
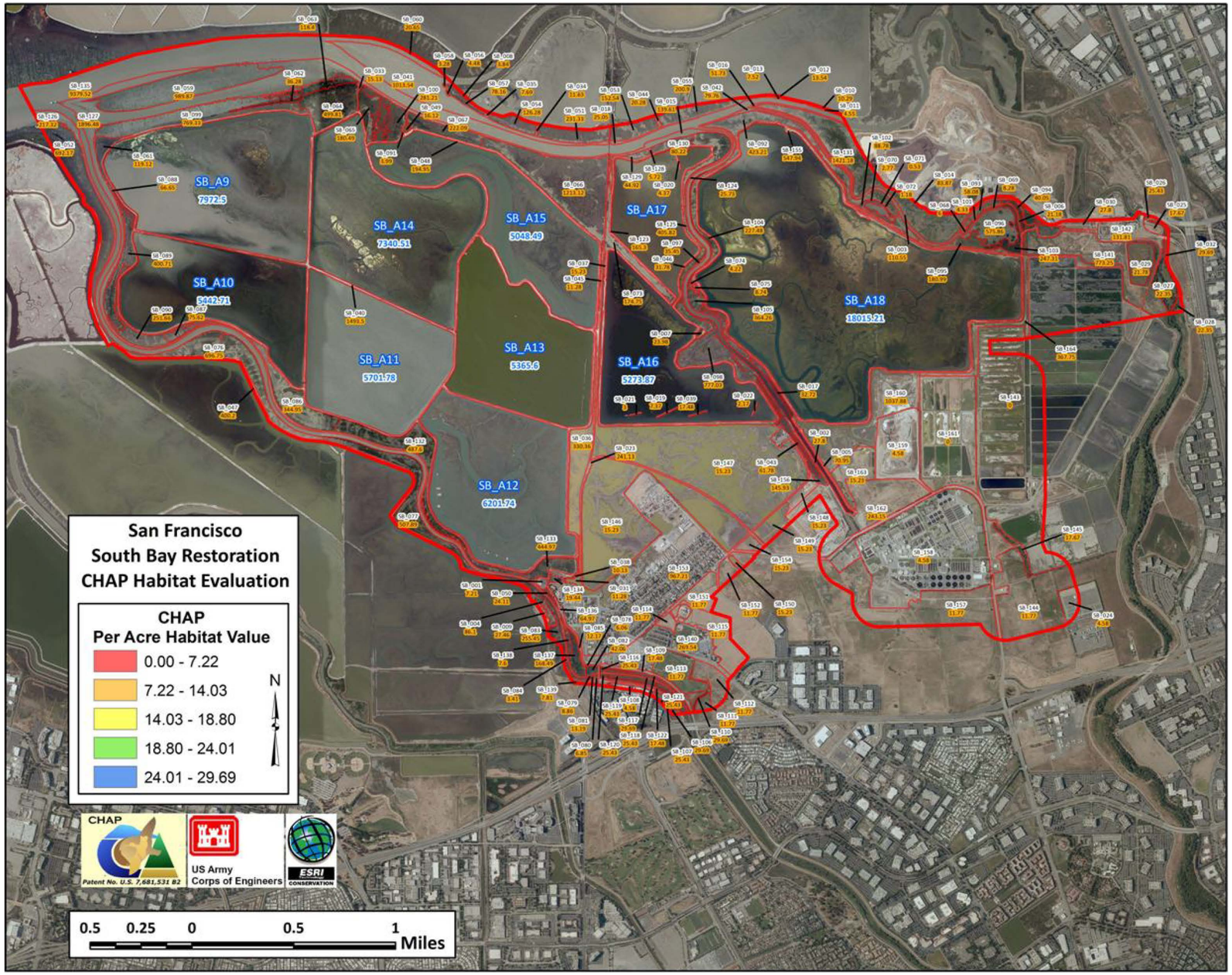


Figure 7. SF South Bay Shoreline project showing the polygon number and associated Habitat Units (HUs).



Validation

Species List - The development of the species list occurred in a series of steps. As mentioned, the Habitat Evaluation Team established that point of contact would be Cheryl Strong from the USFWS. Ms. Strong was able to generate a species list (for both fish and wildlife) working either by herself, with colleagues or through her contacts of knowledgeable people for baseline conditions, alternatives and without project conditions. Northwest Habitat Institute (NHI) was able to generate an initial species list for the project by accessing the California Wildlife Habitat Relationships (CWHR) geographic information system (GIS). A query of the site's potential species was done by accessing the peer reviewed wildlife species range maps that overlapped with the project boundary. Additionally, Ms. Strong from the USFWS was also able to review the NHI generated potential species list, as well as develop specific bird lists for each pond along with determining their presence during the four seasons.

Hence, because local knowledge was being used to a large extent, there was an attempt to acquire another data sets from USGS researchers who also work in the area. Dr. Amana Brand, who works at the Western Ecological Research Center, forwarded the data that she and her colleagues collected for the 2011 season. These data were pond specific, thus allowing a comparison between observers/groups. In evaluating both data sets we found that the USFWS's species list had an 8% omission rate that is USGS stated the birds on their list but was not on USFWS list, but conversely had 18% commission rate whereby species were identified on their list that was not on the USGS list. Because USFWS has staff work near the project site, this may reflect observer(s) knowledge for being at the site over a longer period of time. Nevertheless, omission and commission rates are very acceptable. Lastly, the non-native species identified on the baseline condition species list can be found in Table 6.

Table 7. Non-Native Species evaluated as part of the Baseline condition evaluation

ID	Common Name
10121	Striped bass
10149	Common carp
10177	Goldfish
10189	Western mosquito fish
10233	American shad
10234	Threadfin shad
10361	Cabezon
41190	Ring-necked Pheasant
42380	Rock Pigeon
43740	European Starling
44970	House Sparrow
50010	Virginia opossum
51070	Black rat
51080	Norway rat
51090	House mouse
51160	Red fox

Habitat Findings – No separate set of vegetation transects was run to help verify the results from past habitat inventory for this project site. The data received was well attributed and based on maps that were developed and passed out for a prior review

50 Years Future without Project

Introduction:
CHAP habitat value utilizes species-habitat-functions to derive current habitat values. To determine a change in these values over time, projections are needed to alter either the species, habitat, or function parameters. Applying these changes over several time periods requires some conjecture to deduce the amount of influence that might be expected during each time period. To display the future condition outcomes and help visualize these changes in value over time, the habitat changes are applied to either a coarse of the fine scale habitat map, while the species and function changes are applied to their respective data sets.

At a 25 and 50-year intervals, a future analysis is conducted for the SF South Bay Shoreline Ecosystem Restoration (ER) project area as part of the baseline project feasibility study. The purpose of this assessment is to forecast the conditions in the Shoreline Study area 50 years into the future without the implementation of a federal restoration project. This "future without project" assessment would be equivalent to a "no action" alternative. The baseline assessment was done using 2010 imagery to depict baseline conditions. The 50-year future without project timeframe assesses two future time periods; one at 25 years (2042) and another at 50-years (2067). To undertake this assessment, several projections are made to assess habitats over the 50-year time period. These projections are based on past and current trends in habitat conditions in the area. Specifically, it is reasonable to predict: 1) potentially some species may decline during this time period, 2) an increase in presence of invasive plant species throughout the SF South Bay Shoreline project area would occur, 3) some planned development that will like occur during these time periods, 4) climate change and the potential influence from sea level rise, and 5) continuation of the threat from earthquakes.

1. Potential Species Decline
   The habitat evaluation team discussed a reduction in the number of fish and wildlife taxa present within the project area over time. However, in this case, it was the consensus of the habitat evaluation team that most of the current landscape conditions in and around the South Bay would mostly prevail over time. Therefore, when reviewing the number of species that may decline over the 50 year period, only 4 species were identified as possibly declining within the project area (see Table 7). Thus, 2 species were randomly removed in the first 25 years interval and the remaining 2 species were removed in the later 25 years to reflect this potential decline over the 50-year period.

Table 8. Species that may decline over the next 50 year period

SPP ID	Common Name	Interval Species Removed
42510	Burrowing Owl	First 25 Year Period
41410	Western Snowy Plover	First 25 Year Period
41321	California Clapper Rail	Second 25 Year Period
40780	Redhead Duck	Second 25 Year Period

Because it is assumed that the remaining fish and wildlife species currently identified in the project would likely prevail into the future, it was thought best to establish the current level of functional resiliency. This starts by comparing species functional redundancy between historic (344 species, Appendix A-3) and current baseline conditions (255 species, Appendix A-1). The top 20 functional categories in both time intervals are shown in Figures 8 & 9. Next, when these values are compared side-by-side they show the potential resiliency levels for each functional category (Figure 10). A comparison of species that only perform a few functions was also done but there was little difference between the time periods. However, in a few categories in Figure 10, there is a higher level of functional resiliency occurring in the current baseline than the historic time period. This occurs in the categories of egg eaters, tertiary consumers and fish prey. This is the result of accounting for the non-native species (Table 7), which are mostly generalist, that did not occur in historic time but do currently.

Figure 8. Top 20 Key Ecological Functions for Historic Period.

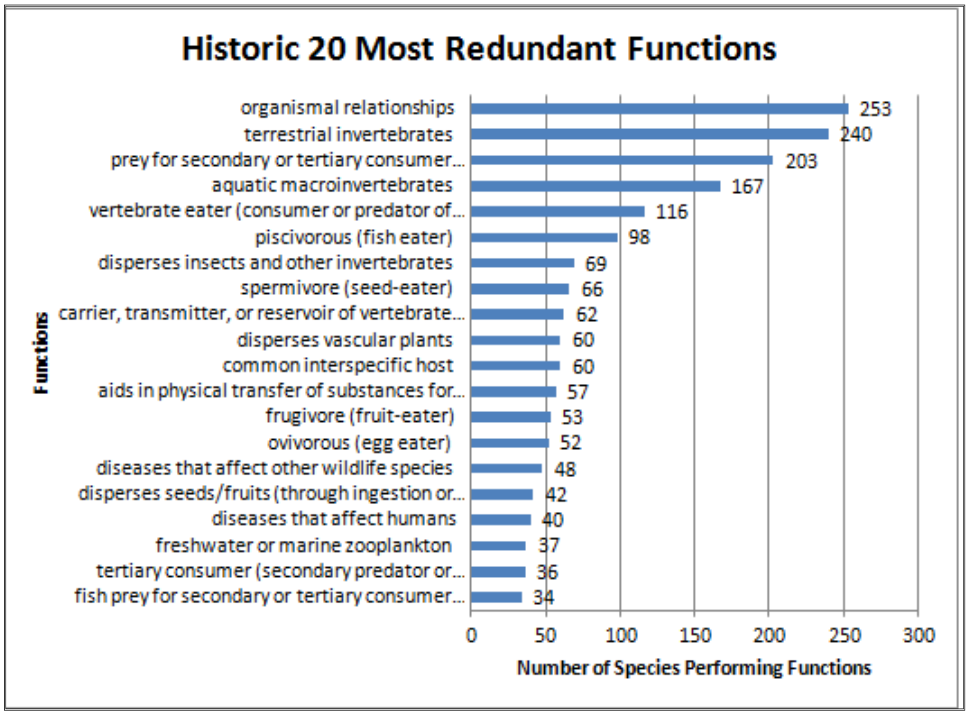


Figure 9. Top 20 Key Ecological Functions for the Current Baseline.

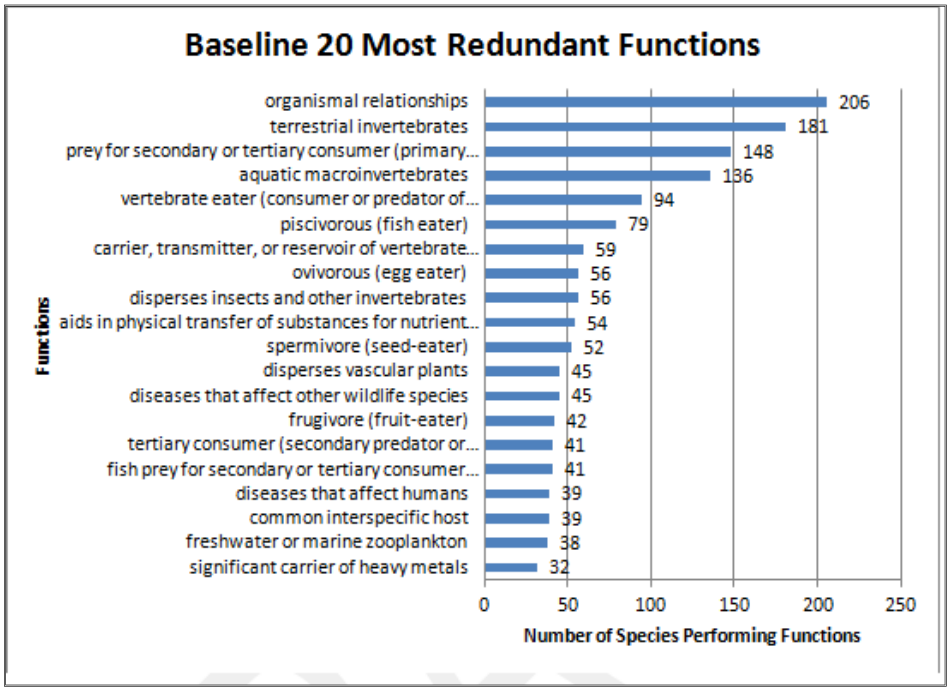
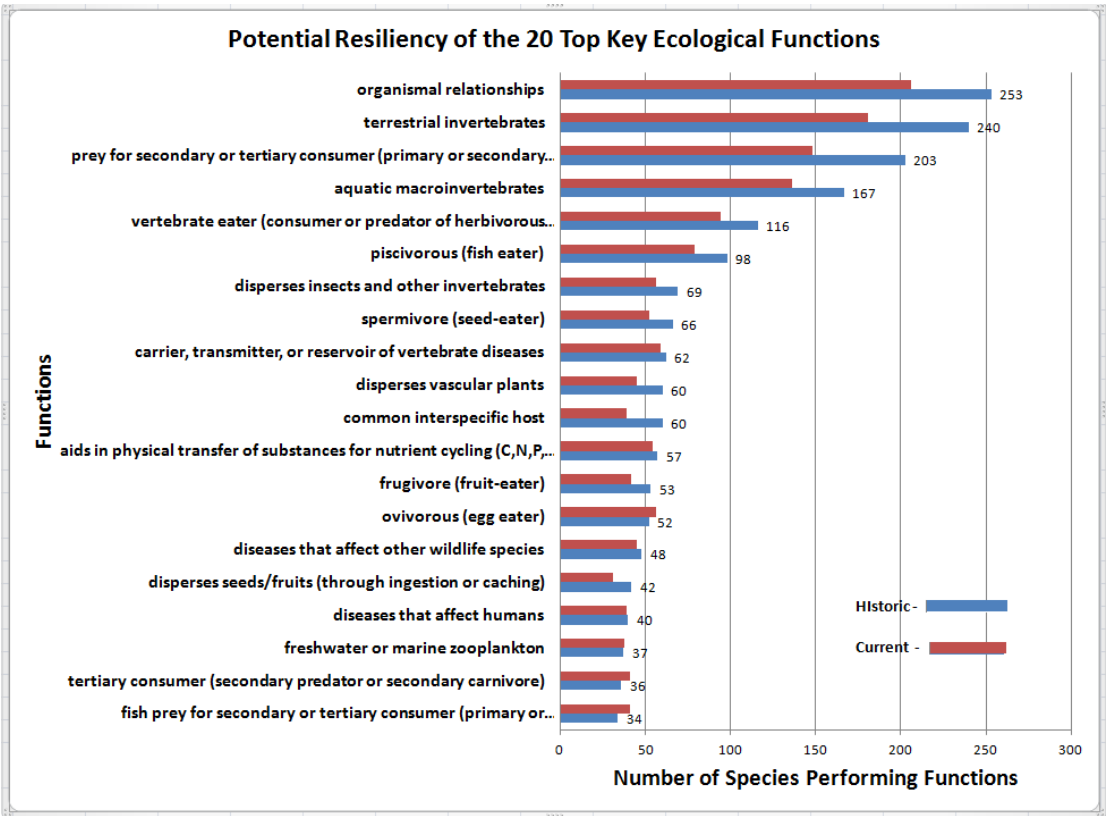


Figure 10. A Comparison between Historic and Current Baseline Conditions for the Top 20 Key Ecological Functions



Next, a quick coarse level assessment of potential cumulative impacts can be shown by comparing San Francisco Bay habitats from historic to modern times (Figure 11). This allows a trajectory to be established that helps frame the current setting and give a general idea of how far we have come from a historical perspective. That is, a coarse scale assessment from then to now will show approximately the change that has occurred in the San Francisco Bay area.

To determine the amount of change in habitat values, it is necessary to establish a species list with each habitat type that was mapped for both time periods. A map showing both historic and modern times can be found at the San Francisco Estuary Institute and is depicted in Figure 11. A species list and their habitat associations, which were determined by professional opinion (USFWS & NHI and IBIS data system) for the historic and modern time periods, can be found in Appendices A-4 and A-5 respectively. Table 9 shows the two separate habitat classifications that were developed to allow the comparison from one time period to the other, In doing this exercise, there was a concern that the vast amount of Tidal Marsh that shown in the historic map would receive an idealistic high value rather than a more realistic one. Hence, 2 sets of historic species lists were generated; one showing 205 species the other depicting 171. Thus, amount of change in habitat types (Table 10a) and 2 historical perspectives are shown Table 10b to illustrate a potential high and low range of change in habitat value from historic to modern times.

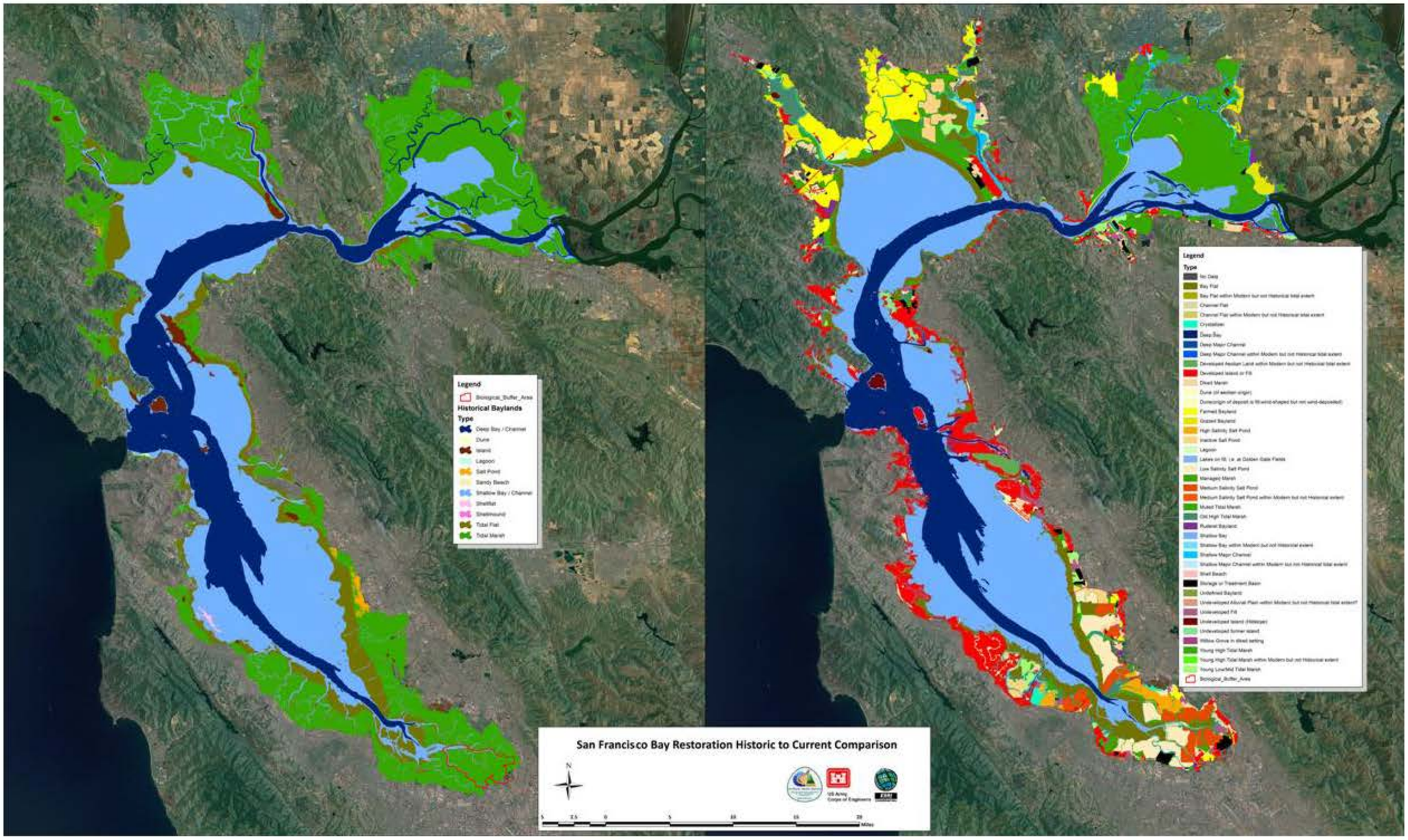


Figure 11. San Francisco Bay comparison between Historic and Modern times habitats (source: San Francisco Estuary Institute).

Historic Conditions San Francisco Bay	Modern Conditions San Francisco Bay
Deep Bay / Channel	Deep Bay / Channel
Dune	Dune
Island	Lagoon
Lagoon	Salt Pond
Salt Pond	Shallow Bay / Channel
Sandy Beach	Tidal Flat
Shallow Bay / Channel	Tidal Marsh
Shellflat	Developed
Shell Mmound	Agriculture
Tidal Flat	No Correlation
Tidal Marsh	

Table 9. Habitat classifications used to compare historic to modern conditions.

Historic Habitat Value Acreages and Proportions											
Habitats	Deep Bay / Channel	Dune	Lagoon	Salt Pond	Sandy Beach	Shallow Bay / Channel	Tidal Flat	Tidal Marsh	Island	Shellflat	Shell Mmound
Acres	99,527.68	54.75	84.17	1,594.53	199.33	174,440.54	50,054.73	189,985.90	4,823.86	395.34	12.01
Proportions	0.19	0.00	0.00	0.00	0.00	0.33	0.10	0.36	0.01	0.00	0.00
											Total Acres**
											521,172.83

Modern Habiat Value Acreages and Proportions											
Habitats	Deep Bay / Channel	Dune	Lagoon	Salt Pond	Shellflat	Shallow Bay / Channel	Tidal Flat	Tidal Marsh	Developed	Agriculture	No Correlation
Acres	82,530.76	2,254.80	2,325.53	29,738.39	12.41	171,838.91	35,313.67	103,501.19	50,341.78	31,738.89	13,789.87
Proportions	0.16	0.00	0.00	0.06	0.00	0.33	0.07	0.20	0.10	0.06	0.03
											Total Acres
**Note: there is a 2,213 acre discrepancy between Historic to Modern timeframe because of a gap not mapped in the Historic map											523,386.19

Table 10a. Acreage change in habitat types from Historic to Modern timesd.

	Habitat Value	Difference Historic to Modern
Historic (High Range Habitat Value)	9,130,514	-2,343,419
Historic (Low Range Habitat Value)	8,516,173	-1,729,077
Modern Times Habitat Value	6,787,095	0

Table 10b. Overall habitat value change from Historic to Modern times.

2. Invasive species would expand in area and abundance – Invasive plant species information for baseline conditions was originally collected from past studies or from knowledgeable staff on site. A value was determined and recorded for each polygon using the percent breakout in Table 11.

Table 11. Invasive plant species deduction factors

Determined Invasive Adjustment	Grouped Class
1 - 0.95	1
0.94 - 0.90	0.9
0.89 - 0.80	0.8
0.79 - 0.70	0.7
0.69 - 0.60	0.6
0.59 -0.50	0.5
0.49 - 0.40	0.4

To determine the influence of invasive species for the without project conditions, the habitat evaluation team expected that the presence and abundance of the invasive species would increase over time. Therefore, the percent invasive species for each polygon at the baseline condition should advance to the next highest percent level for the first 25 years, and to the next level beyond that for the next 25 years. In other words, if the current baseline condition of a polygon has .89-.80 invasive cover, then the condition at Year 25 would be assessed at .79-.70 invasive cover while the condition at Year 50 would be reflected as .69-.60 invasive cover. But the reality of these presumptions occurring may not be realized because salinity values within the ponds may hold the spread of invasive plants in check. Thus, some increase in the spread of invasives may occur and certainly more likely in the above shoreline habitats.

3. Planned Development – In determining future development within the project area, the city of San Jose Planning Services Division future land use and transportation plan was accessed. This document, known as *Envision San Jose 2040 General Plan* shows what the city planners envision over the next several decades. Below is their planning map for the Alviso area that would cover the project site (Figure 12). This information was overlaid onto the existing environment and shows most of the anticipated change through 2040 will occur in the already developed area. The only significant development actions in Alviso aside from the below Master Plan is a proposed height increase for Newby Island Landfill. Finally, there is also a recent San Jose/Santa Clara Water Pollution Control Plant Master Plan that was published in December 2011. This master plan updates the San Jose 2040 Plan. A further discussion of the Water Pollution Control Plant Master Plan can be found in the Climate Change section that follows.

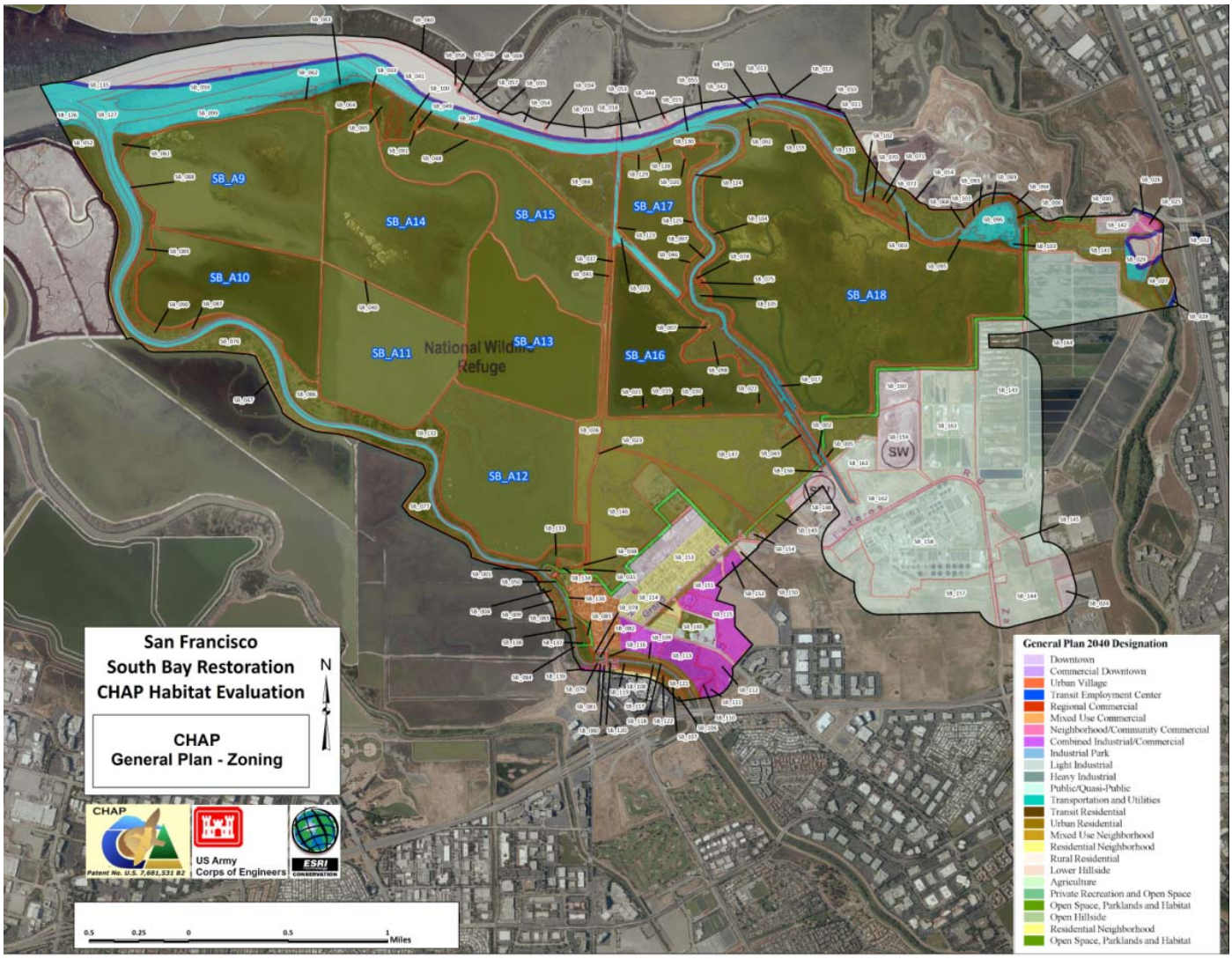
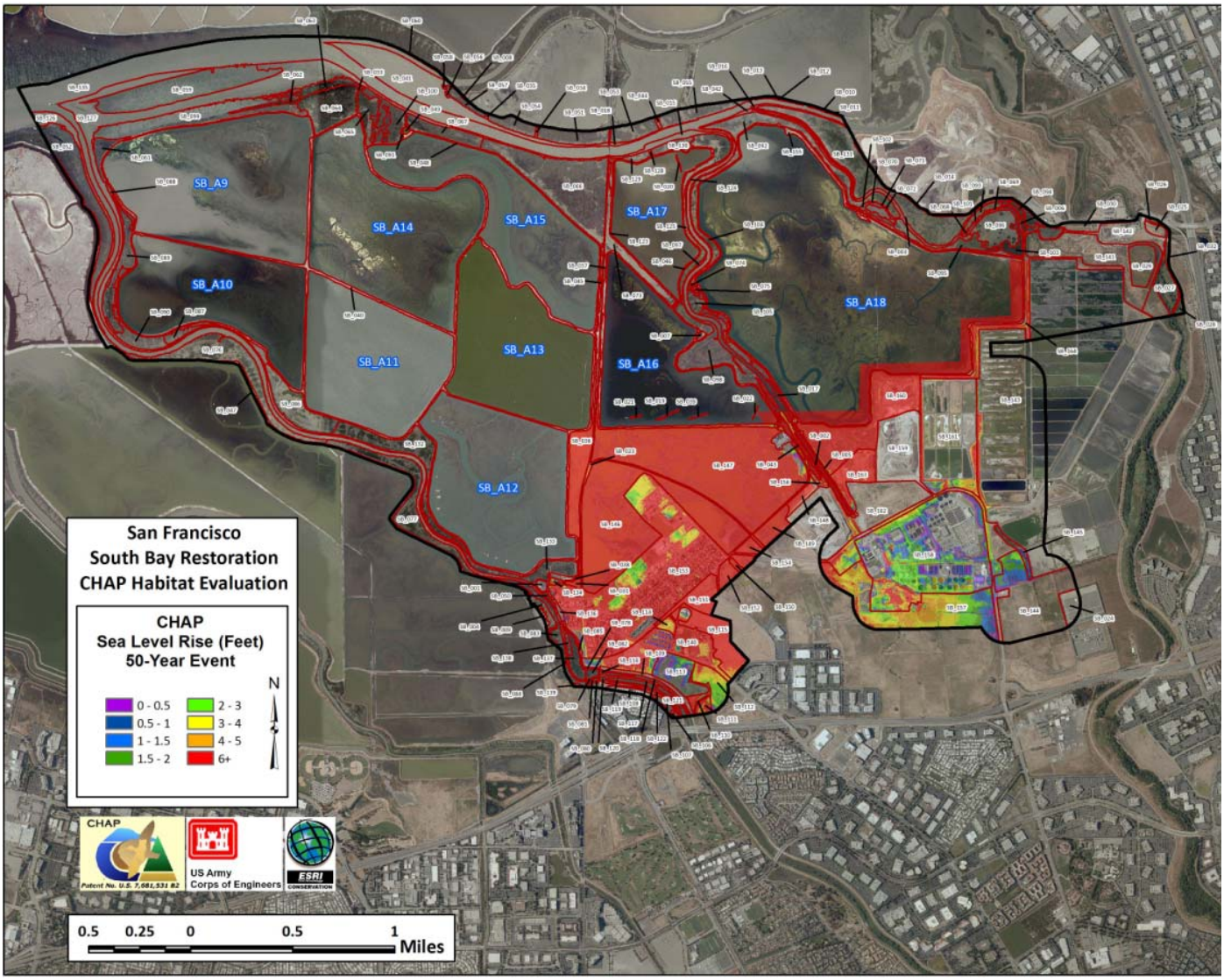


Figure 12. Alviso planning area until 2040. (Source: San Jose Services Planning Division - *Envision San Jose 2040 General Plan*).

Climate Change –Sea Rise – The current distribution, abundance, and vitality of species and habitats are strongly dependent on climatic (and microclimatic) conditions. Climate change is expected to result in warmer temperatures year-round, accompanied by substantially wetter winters. Rising sea level will significantly affect coastal wetlands because they are mostly within a few feet of sea level. As the sea rises, these wetlands will move inland. Part of the current Climate Change Implementation Plan for Adaptation **is** a strategy to complete a statewide sea-level rise vulnerability assessment every five years. In 2006, the California Climate Change Center reported a historic sea-level rise of 7 inches in the last century and projected an additional rise of 4–35 inches by the end of this century. There report uses the 20-55 inch projection, as it was the best available science at the time of the 2009 impacts assessment, but in so doing noted that future sea-level rise estimates will vary based on future GHG emissions (http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy_-_Chapter_6_-_Ocean_and_Coastal_Resources.pdf - accessed 5-2-2012).

To assess the influence of the potential for rising sea level, the habitat evaluation team suggested using the The National Research Council's (NRC) Curve III. This curve simulates a high rate or 1.5 meter rise over the project area and adjacent lands (Figure 15), and we anticipated this event may likely occur once within the 50 year time period. Anticipated impact from a fish and wildlife perspective is that it is assumed there will be an increase in aquatic habitats though the duration maybe short lived. Additionally, if a breach in a levee were to occur it would be quickly repaired. By the end of the 50 years, current without project conditions would be roughly the same. The City is working with the South Bay Shoreline Study to ensure that the Plant is protected from future sea-level rise, and hence are evaluating minimum and maximum levee build out as well as other fortification options. The Coty is also evaluating 3 land use alternatives: Back to the Bay, Necklaces of Lakes, and Riparian Corridor (San Jose/Santa Clara Water Pollution Control Plant (Plant) Master Plan, 2011).

Figure 13. Depiction of the potential impact area from a rise in sea level in and adjacent to the project area.



4. Earthquakes – Earthquakes and their tremors are not uncommon in the San Francisco area. Figures 14a &14b depict the potential earthquake risk in and around the San Francisco area. If an earthquake occurred, the primary impact would be to infrastructure on the site. It is expected that the design and engineering of the current levees and dikes might withstand predictive earthquakes for the area. However, if this infrastructure failed, some flooding may occur and surface water is expected to flow back in the San Francisco South Bay.

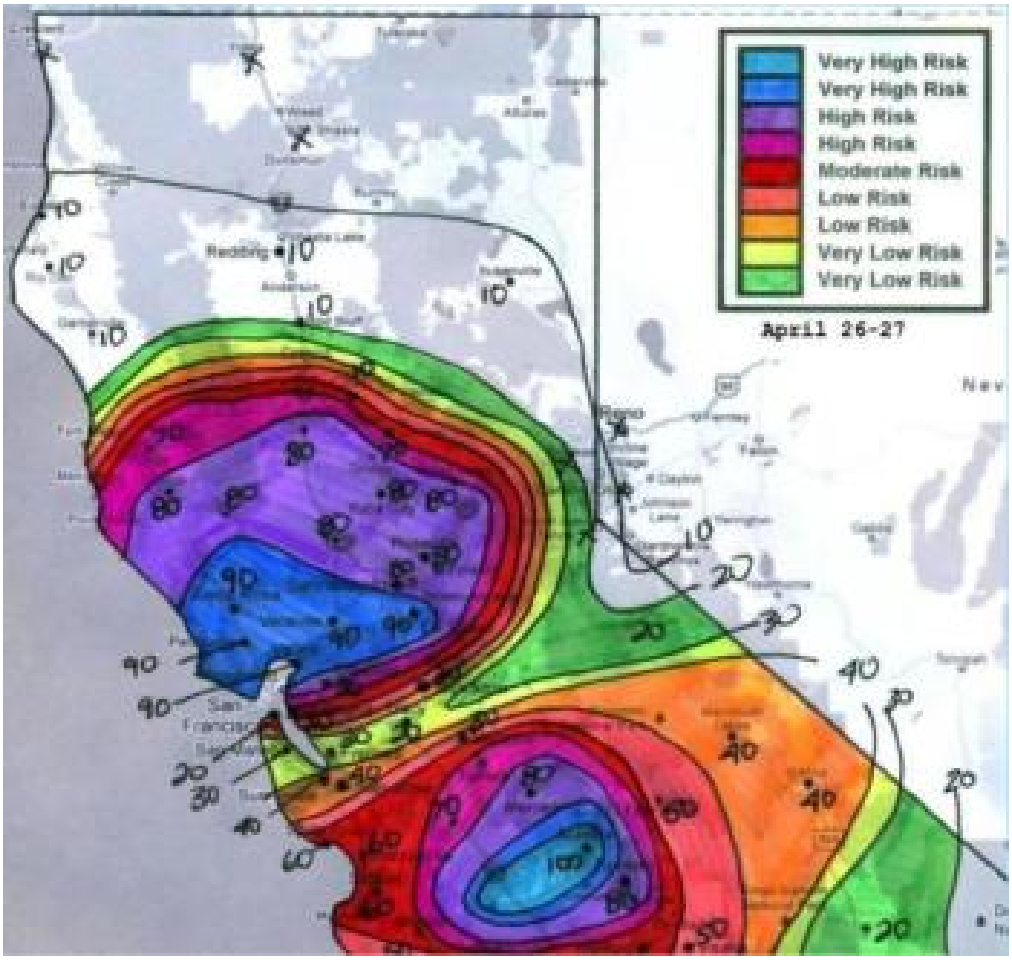


Figure 14a. Earthquake risk map showing the area adjacent to the South Bay as a very low risk. (Source: Quake Prediction, Earthquake Forecast Center, retrieved 04/ 27/2012).

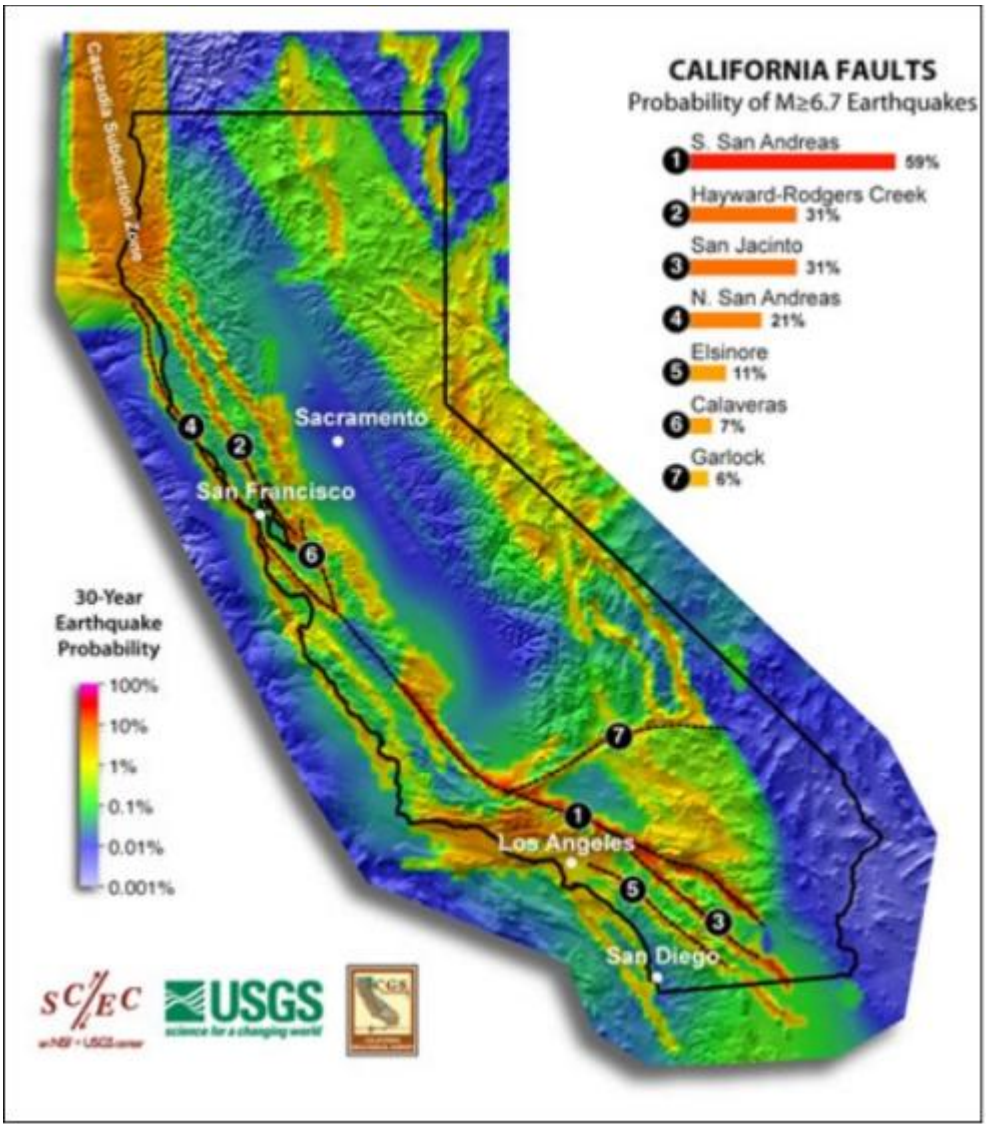


Figure 14b. Shows the major earthquake faults in and around the San Francisco area along with a 30 year probability (Source: National Geographic News October 28, 2010)

Conclusion:

Given the above, the 50 year future without project would appear to show some small decline in habitat value over that time period. This because: knowledgeable staff at the project site thought there would only be a potential loss of only a few species; salinity levels would control the spread of invasive plant species, an assessment from Historic to Modern times shows a relatively high level of functional resiliency given a substantial amount of development occurred within this time period; planned development mostly will occur mostly in already developed areas and; the potential for catastrophic events may actually expand aquatic habitats showing some short-term influences.

Citations:

City of San Jose. 2007. *Envision San Jose 2040 General Plan.* San Jose Services Planning Division. pp. 502.

City of San Jose & Santa Clara. 2011. *San Jose/Santa Clara Water Pollution Control Plant Master Plan.* Task NO 5 – Project Memorandum NO. 10. Land Use Alternatives, Elements and Land Use Plan. 83 pp.

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U.S. Fish and Wildlife Service. 1980, Habitat Evaluation Procedures. Ecological Services Manual (101-104 ESM), Division of Ecological Services, Washington D.C. unnumbered.

Appendix A-1
SF South Bay Project Species List for Baseline Conditions
[252 Fish and Wildlife Species]

SPP ID	Common Name	Scientific Name
10001	Pacific lamprey	*Lampetra tridentata*
10071	Sacramento sucker	*Catostomus occidentalis occidentalis*
10073	Threespine stickleback	*Gasterosteus aculeatus*
10081	Prickly sculpin	*Cottus asper*
10121	Striped bass	*Morone saxatilis*
10149	Common carp	*Cyprinus carpio*
10173	Starry flounder	*Platichthys stellatus*
10177	Goldfish	*Carassius auratus auratus*
10189	Western mosquito fish	*Gambusia affinis*
10221	Pacific staghorn sculpin	*Leptocottus armatus*
10233	American shad	*Alosa sapidissima*
10234	Threadfin shad	*Dorosma petenense*
10237	Shiner perch	*Cymatogaster aggregata*
10238	Tule perch	*Hysterocarpus traski*
10245	Longfin smelt	*Spirinchus thaleichthys*
10249	Green sturgeon	*Acipenser medirostris*
10295	Steelhead	*Oncorhynchus mykiss*
10325	Leopard shark	*Triakis semifasciata*
10326	Brown smoothhound	*Mustelus henlei*
10329	Soupfin shark	*Galeorhinus galeus*
10333	Spiny dogfish	*Squalus acanthias*
10337	Big skate	*Raja binoculata*
10341	California skate	*Raja inornata*
10361	Cabezon	*Scorpaenichthys marmoratus*
10405	Brown rockfish	*Sebastes auriculatus*
10537	English sole	*Parophrys vetulus*
10538	California tonguefish	*Symphurus atricaudus*
10539	Diamond turbot	*Hypsopsetta guttulata*
10545	Pacific sanddab	*Citharichthys sordidus*
10561	Sand sole	*Psettichthys melanostictus*
10585	Chinook salmon	*Oncorhynchus tshawytscha*
10589	pink salmon	*Oncorhynchus gorbuscha*
10593	Chum salmon	*Oncorhynchus keta*
10628	Longjawed mudsucker	*Gillichthys mirabilis*
10629	Bay goby	*Lepidogobius lepidus*

10633	Arrow goby	*Clevelandia ios*
10634	Cheekspot goby	*Ilypnus gilberti*
10637	Speckled sanddab	*Citharichthys stigmaeus*
10641	Pacific herring	*Clupea pallasii*
10648	Barred surfperch	*Amphistichus argenteus*
10653	Surf Smelt	*Hypomesus pretiosus*
10657	Whitebait smelt	*Allosmerus elongatus*
10669	Bay pipefish	*Syngnathus leptorhynchus*
10686	Dwarf surfperch	*Micrometrus minimus*
10729	Plainfin midshipman	*Porichthys notatus*
10757	Topsmelt	*Atherinops affinis*
10758	Jack smelt	*Atherinopsis californiensis*
10765	Pacific sardine	*Sardinops sagax*
10808	Bat ray	*Myliobatis californica*
10817	Northern anchovy	*Engraulis mordax*
11113	White croaker	*Genyonemus lineatus*
11197	California halibut	*Paralichthys californicus*
30100	Southern alligator lizard	*Elgaria multicarinata*
30160	Western fence lizard	*Sceloporus occidentalis*
30290	Gopher snake	*Pituophis melanoleuca*
30320	Western terrestrial garter snake	*Thamnophis elegans*
30340	Common garter snake	*Thamnophis sirtalis*
30350	Western rattlesnakes	Crotalus oreganus
40050	Pied-billed Grebe	*Podilymbus podiceps*
40060	Horned Grebe	*Podiceps auritus*
40070	Red-necked Phalarope	*Phalaropus lobatus*
40080	Eared Grebe	*Podiceps nigricollis*
40090	Western Grebe	*Aechmophorus occidentalis*
40100	Clark’s Grebe	*Aechmophorus clarkii*
40320	American White Pelican	*Pelecanus erythrorhynchos*
40330	Brown Pelican	*Pelecanus occidentalis*
40350	Double-crested Cormorant	*Phalacrocorax auritus*
40380	American Bittern	*Botaurus lentiginosus*
40390	Least Bittern	*Ixobrychus exilis*
40400	Great Blue Heron	*Ardea herodias*
40410	Great Egret	*Ardea alba*
40420	Snowy Egret	*Egretta thula*
40450	Cattle Egret	*Bubulcus ibis*
40460	Green Heron	*Butorides virescens*
40470	Black-crowned Night-Heron	*Nycticorax nycticorax*
40500	Turkey Vulture	*Cathartes aura*

40530	Greater White-fronted Goose	*Anser albifrons*
40570	Canada Goose	*Branta canadensis*
40640	Gadwall	*Anas strepera*
40660	Eurasian Wigeon	*Anas penelope*
40670	American Wigeon	*Anas americana*
40690	Mallard	*Anas platyrhynchos*
40700	Blue-winged Teal	*Anas discors*
40710	Cinnamon Teal	*Anas cyanoptera*
40720	Northern Shoveler	*Anas clypeata*
40730	Northern Pintail	*Anas acuta*
40760	Green-winged Teal	*Anas crecca*
40770	Canvasback	*Aythya valisineria*
40780	Redhead	*Aythya americana*
40790	Ring-necked Duck	*Aythya collaris*
40810	Greater Scaup	*Aythya marila*
40820	Lesser Scaup	*Aythya affinis*
40860	Surf Scoter	*Melanitta perspicillata*
40870	White-winged Scoter	*Melanitta fusca*
40880	Black Scoter	*Melanitta nigra*
40890	Long-tailed Duck	*Clangula hyemalis*
40900	Bufflehead	*Bucephala albeola*
40910	Common Goldeneye	*Bucephala clangula*
40920	Barrow's Goldeneye	*Bucephala islandica*
40940	Hooded Merganser	*Lophodytes cucullata*
40950	Common Merganser	*Mergus merganser*
40970	Ruddy Duck	*Oxyura jamaicensis*
40980	Osprey	*Pandion haliaetus*
40990	White-tailed Kite	*Elanus coeruleus*
41010	Northern Harrier	*Circus cyaneus*
41020	Sharp-shinned Hawk	*Accipiter striatus*
41030	Cooper's Hawk	*Accipiter cooperii*
41050	Red-shouldered Hawk	*Buteo lineatus*
41080	Red-tailed Hawk	*Buteo jamaicensis*
41090	Ferruginous Hawk	*Buteo regalis*
41110	Golden Eagle	*Aquila chrysaetos*
41120	American Kestrel	*Falco sparverius*
41130	Merlin	*Falco columbarius*
41150	Peregrine Falcon	*Falco peregrinus*
41190	Ring-necked Pheasant	*Phasianus colchicus*
41290	California Quail	*Callipepla californica*
41311	California Black Rail	*Laterallus jamaicensis coturniculus*

41320	Virginia Rail	*Rallus limicola*
41321	California Clapper rail	*Rallus longirostris obsoletus*
41330	Sora	*Porzana carolina*
41340	Common Moorhen	*Gallinula chloropus*
41350	American Coot	*Fulica americana*
41370	Black-bellied Plover	*Pluvialis squatarola*
41380	American Golden-Plover	*Pluvialis dominica*
41410	Western Snowy Plover	*Charadrius alexandrinus nivosus*
41420	Semipalmated Plover	*Charadrius semipalmata*
41440	Killdeer	*Charadrius vociferus*
41480	Black-necked Stilt	*Himantopus mexicanus*
41490	American Avocet	*Recurvirostra americana*
41500	Greater Yellowlegs	*Tringa melanoleuca*
41510	Lesser Yellowlegs	*Tringa flavipes*
41540	Willet	*Catoptrophorus semipalmatus*
41570	Spotted Sandpiper	*Actitis macularia*
41590	Whimbrel	*Numenius phaeopus*
41610	Long-billed Curlew	*Numenius americanus*
41640	Marbled Godwit	*Limosa fedoa*
41650	Ruddy Turnstone	*Arenaria interpres*
41700	Sanderling	*Calidris alba*
41710	Semipalmated Sandpiper	*Calidris pusilla*
41720	Western Sandpiper	*Calidris mauri*
41760	Least Sandpiper	*Calidris minutilla*
41820	Dunlin	*Calidris alpina*
41860	Ruff	*Philomachus pugnax*
41870	Short-billed Dowitcher	*Limnodromus griseus*
41880	Long-billed Dowitcher	*Limnodromus scolopaceus*
41900	Wilson’s Phalarope	*Phalaropus tricolor*
42010	Bonaparte’s Gull	*Larus Philadelphia*
42020	Heermann’s Gull	*Larus heermanni*
42030	Mew Gull	*Larus canus*
42040	Ring-billed Gull	*Larus delawarensis*
42050	California Gull	*Larus californicus*
42060	Herring Gull	*Larus argentatus*
42070	Thayer’s Gull	*Larus thayeri*
42100	Western Gull	*Larus occidentalis*
42110	Glaucous-winged Gull	*Larus glaucescens*
42120	Glaucous Gull	*Larus hyperboreus*
42130	Sabine’s Gull	*Xena sabini*
42180	Caspian Tern	*Sterna caspia*

42201	Black Skimmer	*Rynchops niger*
42220	Forster's Tern	*Sterna forsteri*
42230	California Least Tern	*Sterna antillarum browni*
42380	Rock Piegeon	*Columba livia*
42390	Band-tailed Pigeon	*Columba fasciata*
42410	Mourning Dove	*Zenaida macroura*
42440	Barn Owl	*Tyto alba*
42470	Great Horned Owl	*Bubo virginianus*
42510	Burrowing Owl	*Athene cunicularia*
42560	Short-eared Owl	*Asio flammeus*
42650	Anna's Hummingbird	*Calypte anna*
42700	Allen's Hummingbird	*Selasphorus sasin*
42710	Belted Kingfisher	*Ceryle alcyon*
42840	Northern Flicker	*Colaptes auratus*
42940	Pacific-slope Flycatcher	*Empidonax difficilis*
42960	Black Phoebe	*Sayornis nigricans*
42980	Say's Phoebe	*Sayornis saya*
43060	Loggerhead Shrike	*Lanius ludovicianus*
43200	Western Scrub-Jay	*Aphelocoma californica*
43240	American Crow	*Corvus brachyrhynchos*
43260	Common Raven	*Corvus corax*
43280	Horned Lark	*Eremophila alpestris*
43300	Tree Swallow	*Tachycineta bicolor*
43310	Violet-green Swallow	*Tachycineta thalassina*
43320	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
43330	Bank Swallow	*Riparia riparia*
43340	Cliff Swallow	*Petrochelidon pyrrhonota*
43350	Barn Swallow	*Hirundo rustica*
43380	Chestnut-backed Chickadee	*Poecile rufescens*
43400	Oak Titmouse	Baeolophus inornatus
43420	Bushtit	*Psaltriparus minimus*
43490	Bewick's Wren	*Thryomanes bewickii*
43500	House Wren	*Troglodytes aedon*
43520	Marsh Wren	*Cistothorus palustris*
43550	Ruby-crowned Kinglet	*Regulus calendula*
43640	Hermit Thrush	*Catharus guttatus*
43660	American Robin	*Turdus migratorius*
43700	Northern Mockingbird	*Mimus polyglottos*
43740	European Starling	*Sturnus vulgaris*
43820	Cedar Waxwing	*Bombycilla cedrorum*

43970	Yellow-rumped Warbler	*Dendroica coronata*
44000	Townsend’s Warbler	*Dendroica townsendi*
44180	San Francisco common yellowthroat	*Geothlypis trichas sinuosa*
44270	Spotted Towhee	*Pipilo maculatus*
44280	California Towhee	*Pipilo crissalis*
44390	Bryant's savannah sparrow	*Passerculus sandwichensis alaudinus*
44430	Fox Sparrow	*Passerella iliaca*
44440	Alameda song sparrow	*Melospiza melodia pusillula*
44440	Song sparrow	*Melospiza melodia*
44490	White-crowned Sparrow	*Zonotrichia atricapilla*
44500	Golden-crowned Sparrow	*Zonotrichia atricapilla*
44510	Dark-eyed Junco	*Junco hyemalis*
44590	Black-headed Grosbeak	*Pheucticus melanocephalus*
44660	Red-winged Blackbird	*Agelaius phoeniceus*
44670	Tricolored Blackbird	*Agelaius tricolor*
44680	Western Meadowlark	*Sturnella neglecta*
44710	Brewer’s Blackbird	*Euphagus cyanocephalus*
44740	Brown-headed Cowbird	*Molothrus ater*
44760	Hooded Oriole	*Icterus cucullatus*
44790	Bullock’s Oriole	*Icterus bullockii*
44870	House Finch	*Carpodacus mexicanus*
44930	Lesser Goldfinch	*Carduelis psaltria*
44950	American Goldfinch	*Carduelis tristis*
44970	House Sparrow	*Passer domesticus*
50010	Virginia opossum	Didelphis virginiana
50035	Ornate Shrew	Sorex ornatus
50040	Salt marsh wandering shrew	*Sorex vagrans halicoetes*
50110	Trowbridge's Shrew	Sorex trowbridgii
50200	Yuma myotis	*Myotis yumanensis*
50285	Western red bat	*Lasirurs blossevillii*
50290	Hoary bat	*Lasiurus cinereus*
50330	Mexican free-tailed bat	*Tadarida brasiliensis*
50360	Brush rabbit	*Sylvilagus bachmani*
50381	Audubon's cottontail	*Sylvilagus audubonii*
50420	Black-tailed jackrabbit	*Lepus californicus*
50610	California ground squirrel	*Spermophilus beecheyi*
50730	Botta's pocket gopher	*Thomomys bottae*
50820	Western harvest mouse	*Reithrodontomys megalotis*

50821	Salt marsh harvest mouse	*Reithrodontomys raviventris raviventris*
50830	Deer mouse	*Peromyscus maniculatus*
50990	California vole	*Microtus californicus*
51050	Common muskrat	*Ondatra zibethicus*
51070	Black rat	*Rattus rattus*
51080	Norway rat	*Rattus norvegicus*
51090	House mouse	*Mus musculus*
51140	Coyote	*Canis latrans*
51160	Red fox	*Vulpes vulpes*
51180	Gray fox	*Urocyon cinereoargenteus*
51220	Raccoon	*Procyon lotor*
51260	Long-tailed weasel	*Mustela frenata*
51310	Striped skunk	*Mephitis mephitis*
51330	Mountain lion	Felis concolor
51405	Mule Deer	*Odocoileus hemionus*
60040	Pacific harbor seal	*Phoca vitulina richardsi*

Appendix A-2
Species and Habitat Associations for Baseline Conditions
[252 Fish and Wildlife Species]

Common Name	Batch Pond	Brackish Marsh	Developed	Freshwater Marsh	Landfill	Levee	Managed Pond	Mudflat	Muted Tidal / Diked Marsh	Open Water /Slough Channel	Parks / Upland Grassland	Riparian/Creek Corridor	Saline Marsh	Seasonal Wetland	Upland Vegetation
Pacific lamprey										1					
Sacramento sucker										1					
Threespine stickleback							1			1					
Prickly sculpin										1					
Striped bass										1					
Common carp										1					
Starry flounder										1					
Goldfish										1					
Western mosquito fish										1					
Pacific staghorn sculpin							1			1					
American shad										1					
Threadfin shad										1					
Shiner perch							1			1					
Tule perch										1					
Longfin smelt										1					
Green sturgeon										1					
Steelhead (Central California Coast DPS)										1					
Leopard shark							1			1					

Brown smoothhound							1			1						
Soupfin shark										1						
Spiny dogfish										1						
Big skate										1						
California skate										1						
Cabezon										1						
Brown rockfish										1						
English sole										1						
California tonguefish										1						
Diamond turbot							1			1						
Pacific sanddab										1						
Sand sole										1						
Chinook salmon										1						
pink salmon										1						
Chum salmon										1						
Longjawed mudsucker							1			1						
Bay goby										1						
Arrow goby										1						
Cheekspot goby										1						
Speckled sanddab							1			1						
Pacific herring										1						
Barred surfperch							1			1						
Surf Smelt										1						
Whitebait smelt										1						
Bay pipefish							1			1						
Dwarf surfperch										1						
Plainfin midshipman										1						
Topsmelt							1			1						
Jack smelt										1						
Pacific sardine										1						
Bat ray							1			1						

Northern anchovy							1			1					
White croaker										1					
California halibut										1					
Southern alligator lizard					1						1				1
Western fence lizard					1						1				1
Gopher snake					1						1	1			1
Western terrestrial garter snake					1						1	1			1
Common garter snake					1						1	1			1
Western rattlesnakes					1						1				1
Pied-billed Grebe	1			1			1			1		1			
Horned Grebe	1			1			1			1		1			
Red-necked Phalarope	1						1								
Eared Grebe	1			1			1			1					
Western Grebe	1						1			1					
Clark's Grebe	1						1			1					
American White Pelican	1			1		1	1			1					
Brown Pelican	1					1	1								
Double-crested Cormorant	1			1		1	1			1					
American Bittern		1		1				1				1	1		
Least Bittern		1		1				1				1	1		
Great Blue Heron	1	1		1	1	1	1	1	1			1	1		
Great Egret		1		1		1	1	1	1			1	1		
Snowy Egret	1	1		1		1	1	1	1			1	1		
Cattle Egret		1		1		1						1			
Green Heron		1		1								1			
Black-crowned Night-Heron		1		1	1							1			
Turkey Vulture	1				1	1									1

Greater White-fronted Goose				1		1	1		1		1				
Canada Goose		1	1	1		1	1		1	1	1		1		1
Gadwall	1	1		1		1	1		1	1		1			
Eurasian Wigeon				1			1			1					
American Wigeon				1					1	1					
Mallard	1	1		1		1	1		1	1	1	1			
Blue-winged Teal		1		1					1	1		1			
Cinnamon Teal		1		1					1	1		1			
Northern Shoveler	1	1		1		1	1		1	1					
Northern Pintail	1			1					1	1					
Green-winged Teal	1	1		1			1		1	1					
Canvasback		1		1			1		1	1					
Redhead				1			1			1					
Ring-necked Duck				1			1			1					
Greater Scaup	1						1								
Lesser Scaup	1	1					1								
Surf Scoter							1								
White-winged Scoter							1								
Black Scoter							1								
Long-tailed Duck							1								
Bufflehead	1						1			1					
Common Goldeneye							1			1					
Barrow’s Goldeneye							1								
Hooded Merganser				1			1			1		1			
Common Merganser				1			1			1		1			
Ruddy Duck	1			1		1	1			1					
Osprey										1		1			1
White-tailed Kite		1		1								1			1
Northern Harrier		1		1					1				1		1
Sharp-shinned Hawk												1			1

Cooper's Hawk					1							1			1
Red-shouldered Hawk					1							1			1
Red-tailed Hawk					1							1			1
Ferruginous Hawk					1							1			1
Golden Eagle					1										1
American Kestrel															1
Merlin															1
Peregrine Falcon					1										1
Ring-necked Pheasant					1						1	1			1
California Quail											1	1			1
California Black Rail													1		
Virginia Rail		1		1					1						
California Clapper rail									1				1		
Sora		1		1									1		
Common Moorhen		1		1								1	1		
American Coot	1	1		1			1	1	1	1	1	1	1		1
Black-bellied Plover	1			1		1	1	1							
American Golden-Plover				1		1	1	1							
Western Snowy Plover				1		1	1	1						1	
Semipalmated Plover				1		1	1	1							
Killdeer	1		1	1		1	1	1						1	1
Black-necked Stilt	1			1		1	1	1	1				1		
American Avocet	1	1		1		1	1	1	1				1	1	
Greater Yellowlegs	1			1		1	1	1	1				1	1	
Lesser Yellowlegs	1			1		1	1	1	1				1	1	
Willet	1			1		1	1	1					1	1	
Spotted Sandpiper				1				1	1				1		
Whimbrel	1					1	1	1							
Long-billed Curlew	1			1		1	1	1	1				1		
Marbled Godwit	1			1		1	1	1	1				1		

Ruddy Turnstone				1		1	1	1							
Sanderling	1						1	1							
Semipalmated Sandpiper				1		1	1	1							
Western Sandpiper				1		1	1	1						1	
Least Sandpiper	1			1		1	1	1						1	
Dunlin	1			1		1	1	1						1	
Ruff	1							1	1						
Short-billed Dowitcher	1			1		1	1	1						1	
Long-billed Dowitcher	1			1		1	1	1						1	
Wilson’s Phalarope	1						1								
Bonaparte’s Gull	1			1		1	1								
Heermann’s Gull				1		1	1								
Mew Gull	1			1		1	1								
Ring-billed Gull	1		1	1	1	1	1			1	1		1		
California Gull	1		1	1	1	1	1		1	1	1		1		
Herring Gull	1			1	1	1	1			1			1		
Thayer’s Gull	1			1	1	1	1			1					
Western Gull	1		1	1	1	1	1			1	1		1		
Glaucous-winged Gull				1	1	1	1			1	1				
Glaucous Gull				1	1	1	1								
Sabine’s Gull				1		1	1								
Caspian Tern	1			1		1	1			1					
Black Skimmer						1	1			1					
Forster’s Tern	1			1		1	1			1					
California Least Tern						1	1			1					
Rock Pigeon			1		1						1				1
Band-tailed Pigeon			1								1				1
Mourning Dove			1		1						1				1
Barn Owl											1	1			1
Great Horned Owl											1	1			1

Burrowing Owl					1				1		1				1
Short-eared Owl				1											1
Anna's Hummingbird											1	1			1
Allen's Hummingbird											1	1			1
Belted Kingfisher		1		1								1			
Northern Flicker											1	1			1
Pacific-slope Flycatcher												1			1
Black Phoebe			1						1		1	1	1		1
Say's Phoebe											1	1			1
Loggerhead Shrike											1	1			1
Western Scrub-Jay			1		1						1	1			1
American Crow			1		1						1	1			1
Common Raven	1		1		1						1	1			1
Horned Lark					1										1
Tree Swallow				1						1		1			1
Violet-green Swallow				1						1		1			1
Northern Rough-winged Swallow				1						1		1			1
Bank Swallow				1						1		1			1
Cliff Swallow				1						1		1			1
Barn Swallow				1						1		1			1
Chestnut-backed Chickadee											1	1			1
Oak Titmouse											1	1			1
Bushtit											1	1			1
Bewick's Wren				1								1			1
House Wren			1								1	1			1
Marsh Wren				1					1			1	1		
Ruby-crowned Kinglet											1	1			1
Hermit Thrush											1	1			1
American Robin			1								1	1			1

Northern Mockingbird			1		1						1	1			1
European Starling			1		1						1	1			1
Cedar Wa1wing											1	1			1
Yellow-rumped Warbler											1	1			1
Townsend’s Warbler											1	1			1
San Francisco common yellowthroat		1							1			1			
Spotted Towhee											1	1			1
California Towhee											1	1			1
Bryant's savannah sparrow				1							1	1			1
Fo1 Sparrow											1	1			1
Alameda song sparrow		1		1					1			1	1		1
White-crowned Sparrow		1							1		1	1			1
Golden-crowned Sparrow		1							1		1	1			1
Dark-eyed Junco											1	1			1
Black-headed Grosbeak											1	1			1
Red-winged Blackbird		1		1								1			1
Tricolored Blackbird		1		1								1			1
Western Meadowlark		1		1							1	1			1
Brewer’s Blackbird			1		1						1	1			1
Brown-headed Cowbird											1	1			1
Hooded Oriole											1	1			1
Bullock’s Oriole											1	1			1
House Finch			1								1	1			1
Lesser Goldfinch											1	1			1
American Goldfinch											1	1			1
House Sparrow			1		1						1	1			1
Virginia opossum			1		1						1	1			1

Ornate Shrew		1							1				1		1
Salt marsh wandering shrew		1							1				1		1
Trowbridge's Shrew															1
Yuma myotis											1	1			1
Western red bat											1	1			1
Hoary bat											1	1			1
Mexican free-tailed bat											1	1			1
Brush rabbit											1	1			1
Audubon's cottontail											1	1			1
Black-tailed jackrabbit					1							1			1
California ground squirrel					1						1				1
Botta's pocket gopher					1										1
Western harvest mouse		1							1				1		
Salt marsh harvest mouse		1							1				1		
Deer mouse									1				1		1
California vole		1			1				1		1	1	1		1
Common muskrat		1							1	1		1	1		1
Black rat			1		1							1			1
Norway rat			1		1				1				1		1
House mouse			1		1				1				1		1
Coyote											1	1			1
Red fox												1			1
Gray fox												1			1
Raccoon			1		1						1	1			1
Long-tailed weasel												1			1
Striped skunk			1		1							1			1
Mountain lion												1			1
Mule Deer											1	1			1
Pacific harbor seal								1		1			1		

Appendix A-3
SF South Bay Project for Without Project Conditions
[344 Fish and Wildlife Species used for Historic Functional Redundancy & Resiliency Evaluation]

SPP ID	Common Name	Scientific Name	Classification
10001	Pacific lamprey*	*Lampetra tridentata*	native
10071	Sacramento sucker *	*Catostomus occidentalis occidentalis*	native
10073	Threespine stickleback*	*Gasterosteus aculeatus*	native
10081	Prickly sculpin*	*Cottus asper*	native
10173	Starry flounder*	*Platichthys stellatus*	native
10221	Pacific staghorn sculpin*	*Leptocottus armatus*	native
10237	Shiner perch*	*Cymatogaster aggregata*	native
10238	Tule perch*	*Hysterocarpus traski*	native
10245	Longfin smelt*	*Spirinchus thaleichthys*	native
10249	Green sturgeon*	*Acipenser medirostris*	native
10295	Steelhead *	*Oncorhynchus mykiss*	native
10325	Leopard shark*	*Triakis semifasciata*	native
10326	Brown smoothhound*	*Mustelus henlei*	native
10329	Soupfin shark*	*Galeorhinus galeus*	native
10333	Spiny dogfish*	*Squalus acanthias*	native
10337	Big skate*	*Raja binoculata*	native
10341	California skate*	*Raja inornata*	native
10405	Brown rockfish*	*Sebastes auriculatus*	native
10537	English sole*	*Parophrys vetulus*	native
10538	California tonguefish*	*Symphurus atricaudus*	native
10539	Diamond turbot*	*Hypsopsetta guttulata*	native
10545	Pacific sanddab*	*Citharichthys sordidus*	native
10561	Sand sole*	*Psettichthys melanostictus*	native
10585	Chinook salmon *	*Oncorhynchus tshawytscha*	native
10589	Pink salmon*	*Oncorhynchus gorbuscha*	native
10593	Chum salmon*	*Oncorhynchus keta*	native

10628	Longjawed mudsucker*	*Gillichthys mirabilis*	native
10629	Bay goby*	*Lepidogobius lepidus*	native
10633	Arrow goby*	*Clevelandia ios*	native
10634	Cheekspot goby*	*Ilypnus gilberti*	native
10637	Speckled sanddab*	*Citharichthys stigmaeus*	native
10641	Pacific herring*	*Clupea pallasii*	native
10648	Barred surfperch*	*Amphistichus argenteus*	native
10653	Surf Smelt*	*Hypomesus pretiosus*	native
10657	Whitebait smelt*	*Allosmerus elongatus*	native
10669	Bay pipefish*	*Syngnathus leptorhynchus*	native
10686	Dwarf surfperch*	*Micrometrus minimus*	native
10729	Plainfin midshipman*	*Porichthys notatus*	native
10757	Topsmelt *	*Atherinops affinis*	native
10758	Jack smelt*	*Atherinopsis californiensis*	native
10765	Pacific sardine*	*Sardinops sagax*	native
10808	Bat ray*	*Myliobatis californica*	native
10817	Northern anchovy *	*Engraulis mordax*	native
11113	White croaker*	*Genyonemus lineatus*	native
11197	California halibut*	*Paralichthys californicus*	native
20010	California tiger salamander	*Ambystoma californiense*	native
20210	California slender salamander	*Batrachoseps attenuatus*	native
20217	Arboreal salamander	*Aneides lugubris*	native
20260	Pacific tree frog	*Pseudacris regilla*	native
30030	Western pond turtle	*Clemmys marmorata*	native
30100	Southern alligator lizard *	*Elgaria multicarinata*	native
30160	Western fence lizard *	*Sceloporus occidentalis*	native
30180	Western skink	*Eumeces skiltonianus*	native
30290	Gopher snake *	*Pituophis melanoleuca*	native
30320	Western terrestrial garter snake *	*Thamnophis elegans*	native
30340	Common garter snake *	*Thamnophis sirtalis*	native
30350	Western rattlesnakes *	*Crotalus oreganus*	native

40010	Red-throated Loon *	*Gavia stellata*	native
40020	Pacific Loon *	*Gavia pacifica*	native
40030	Common Loon *	*Gavia immer*	native
40050	Pied-billed Grebe*	*Podilymbus podiceps*	native
40060	Horned Grebe*	*Podiceps auritus*	native
40070	Red-necked Grebe *	*Podiceps grisegena*	native
40080	Eared Grebe*	*Podiceps nigricollis*	native
40090	Western Grebe*	*Aechmophorus occidentalis*	native
40100	Clark's Grebe*	*Aechmophorus clarkii*	native
40300	Brown Booby*	*Sula leucogaster*	native
40320	American White Pelican*	*Pelecanus erythrorhynchos*	native
40330	Brown Pelican*	*Pelecanus occidentalis*	native
40340	Brandt's Cormorant *	*Phalacrocorax penicillatus*	native
40350	Double-crested Cormorant*	*Phalacrocorax auritus*	native
40360	Pelagic Cormorant *	*Phalacrocorax pelagicus*	native
40370	Magnificent Frigatebird*	*Fregata magnificens*	native
40380	American Bittern *	*Botaurus lentiginosus*	native
40390	Least Bittern *	*Ixobrychus exilis*	native
40400	Great Blue Heron*	*Ardea herodias*	native
40410	Great Egret *	*Ardea alba*	native
40420	Snowy Egret *	*Egretta thula*	native
40430	Little Blue Heron*	*Egretta caerulea*	native
40450	Cattle Egret *	*Bubulcus ibis*	native
40460	Green Heron *	*Butorides virescens*	native
40470	Black-crowned Night-Heron *	*Nycticorax nycticorax*	native
40490	White-faced Ibis	*Plegadis chihi*	native
40490	Glossy Ibis	*Plegadis falcinellus*	native
40500	Turkey Vulture *	*Cathartes aura*	native
40530	Greater White-fronted Goose*	*Anser albifrons*	native
40550	Snow Goose *	*Chen hyperborea*	native
40560	Ross's Goose *	*Chen rossii*	native

40570	Canada Goose *	*Branta canadensis*	native
40575	Cackling Goose	*Branta hutchinsii*	native
40580	Brant	*Branta bernicla*	native
40610	Tundra Swan *	*Cygnus columbianus*	native
40640	Gadwall *	*Anas strepera*	native
40660	Eurasian Wigeon *	*Anas penelope*	native
40670	American Wigeon *	*Anas americana*	native
40690	Mallard *	*Anas platyrhynchos*	native
40700	Blue-winged Teal *	*Anas discors*	native
40710	Cinnamon Teal*	*Anas cyanoptera*	native
40720	Northern Shoveler*	*Anas clypeata*	native
40730	Northern Pintail*	*Anas acuta*	native
40760	Green-winged Teal*	*Anas crecca*	native
40770	Canvasback*	*Aythya valisineria*	native
40780	Redhead*	*Aythya americana*	native
40790	Ring-necked Duck *	*Aythya collaris*	native
40810	Greater Scaup*	*Aythya marila*	native
40820	Lesser Scaup*	*Aythya affinis*	native
40860	Surf Scoter *	*Melanitta perspicillata*	native
40870	White-winged Scoter*	*Melanitta fusca*	native
40880	Black Scoter*	*Melanitta nigra*	native
40890	Long-tailed Duck *	*Clangula hyemalis*	native
40900	Bufflehead*	*Bucephala albeola*	native
40910	Common Goldeneye*	*Bucephala clangula*	native
40940	Hooded Merganser*	*Lophodytes cucullata*	native
40950	Common Merganser*	*Mergus merganser*	native
40960	Red-breasted Merganser*	*Mergus serrator*	native
40970	Ruddy Duck*	*Oxyura jamaicensis*	native
40980	Osprey *	*Pandion haliaetus*	native
40990	White-tailed Kite *	*Elanus coeruleus*	native
41000	Bald Eagle *	*Haliaeetus leucocephalus*	native

41010	Northern Harrier *	*Circus cyaneus*	native
41020	Sharp-shinned Hawk	*Accipiter striatus*	native
41030	Cooper's Hawk *	*Accipiter cooperii*	native
41050	Red-shouldered Hawk*	*Buteo lineatus*	native
41080	Red-tailed Hawk *	*Buteo jamaicensis*	native
41090	Ferruginous Hawk *	*Buteo regalis*	native
41100	Rough-legged Hawk	*Buteo lagopus*	native
41110	Golden Eagle *	*Aquila chrysaetos*	native
41120	American Kestrel	*Falco sparverius*	native
41130	Merlin *	*Falco columbarius*	native
41150	Peregrine Falcon*	*Falco peregrinus*	native
41160	Prairie Falcon	*Falco mexicanus*	native
41260	Wild Turkey	*Meleagris gallopavo*	native
41290	California Quail	*Callipepla californica*	native
41311	California Black Rail*	*Rallus longirostris obsoletus*	native
41320	Virginia Rail *	*Laterallus jamaicensis coturniculus*	native
41321	California Clapper Rail*	*Rallus limicola*	native
41330	Sora *	*Porzana carolina*	native
41340	Common Moorhen*	*Gallinula chloropus*	native
41350	American Coot*	*Fulica americana*	native
41360	Sandhill Crane	*Grus canadensis*	native
41370	Black-bellied Plover*	*Pluvialis squatarola*	native
41380	American Golden-Plover*	*Pluvialis dominica*	native
41390	Pacific Golden-Plover*	*Pluvialis fulva*	native
41410	Western Snowy Plover*	*Charadrius alexandrinus nivosus*	native
41420	Semipalmated Plover*	*Charadrius semipalmata*	native
41440	Killdeer *	*Charadrius vociferus*	native
41470	Black Oystercatcher*	*Haematopus bachmani*	native
41480	Black-necked Stilt*	*Himantopus mexicanus*	native
41490	American Avocet*	*Recurvirostra americana*	native
41500	Greater Yellowlegs*	*Tringa melanoleuca*	native

41510	Lesser Yellowlegs*	*Tringa flavipes*	native
41530	Solitary Sandpiper	*Tringa solitaria*	native
41540	Willet*	*Catoptrophorus semipalmatus*	native
41550	Wandering Tattler*	*Heteroscelus incanus*	native
41570	Spotted Sandpiper*	*Actitis macularia*	native
41590	Whimbrel *	*Numenius phaeopus*	native
41610	Long-billed Curlew*	*Numenius americanus*	native
41620	Hudsonian Godwit	*Limosa haemastica*	native
41630	Bar-tailed Godwit	*Limosa lapponica*	native
41640	Marbled Godwit*	*Limosa fedoa*	native
41650	Ruddy Turnstone *	*Arenaria interpres*	native
41660	Black Turnstone *	*Arenaria melanocephala*	native
41670	Surfbird*	*Aphriza virgata*	native
41690	Red Knot*	*Calidris canutus*	native
41700	Sanderling *	*Calidris alba*	native
41710	Semipalmated Sandpiper*	*Calidris pusilla*	native
41720	Western Sandpiper*	*Calidris mauri*	native
41740	Little Stint	*Calidris minuta*	native
41760	Least Sandpiper*	*Calidris minutilla*	native
41780	Baird's Sandpiper*	*Calidris bairdii*	native
41790	Pectoral Sandpiper*	*Calidris melanotos*	native
41800	Sharp-tailed Sandpiper*	*Calidris acuminata*	native
41820	Dunlin*	*Calidris alpina*	native
41830	Curlew Sandpiper	*Calidris ferruginea*	native
41840	Stilt Sandpiper*	*Calidris himantopus*	native
41850	Buff-breasted Sandpiper*	*Tryngites subruficollis*	native
41860	Ruff *	*Philomachus pugnax*	native
41870	Short-billed Dowitcher*	*Limnodromus griseus*	native
41880	Long-billed Dowitcher*	*Limnodromus scolopaceus*	native
41890	Wilson's Snipe*	*Gallinago delicata*	native
41900	Wilson's Phalarope*	*Phalaropus tricolor*	native

41910	Red-necked Phalarope *	*Phalaropus lobatus*	native
41920	Red Phalarope	*Phalaropus fulicaria*	native
41950	Parasitic Jaeger	*Stercorarius parasiticus*	native
41980	Franklin's Gull *	*Larus pipixcan*	native
41990	Little Gull	*Larus minutus*	native
42000	Black-headed Gull	*Larus ridibundus*	native
42010	Bonaparte's Gull*	*Larus Philadelphia*	native
42020	Heermann's Gull *	*Larus heermanni*	native
42030	Mew Gull*	*Larus canus*	native
42040	Ring-billed Gull*	*Larus delawarensis*	native
42050	California Gull*	*Larus californicus*	native
42060	Herring Gull*	*Larus argentatus*	native
42070	Thayer's Gull*	*Larus thayeri*	native
42090	Slaty-backed Gull*	*Larus schistisagus*	native
42100	Western Gull*	*Larus occidentalis*	native
42110	Glaucous-winged Gull*	*Larus glaucescens*	native
42120	Glaucous Gull*	*Larus hyperboreus*	native
42130	Sabine's Gull *	*Xena sabini*	native
42180	Caspian Tern*	*Sterna caspia*	native
42190	Elegant Tern*	*Sterna elegans*	native
42200	Common Tern*	*Sterna hirundo*	native
42201	Black Skimmer*	*Rynchops niger*	native
42210	Arctic Tern*	*Sterna paradisaea*	native
42220	Forster's Tern*	*Sterna forsteri*	native
42230	California Least Tern*	*Sterna antillarum browni*	native
42240	Black Tern	*Chlidonias niger*	native
42250	Common Murre	*Uria aalge*	native
42270	Pigeon Guillemot	*Cepphus columba*	native
42320	Ancient Murrelet	*Synthliboramphus antiquus*	native
42390	Band-tailed Pigeon*	*Columba fasciata*	native
42410	Mourning Dove *	*Zenaida macroura*	native

42440	Barn Owl*	*Tyto alba*	native
42470	Great Horned Owl	*Bubo virginianus*	native
42510	Burrowing Owl	*Athene cunicularia*	native
42560	Short-eared Owl *	*Asio flammeus*	native
42620	Vaux's Swift	*Chaetura vauxi*	native
42630	White-throated Swift	*Aeronautes saxatalis*	native
42640	Black-chinned Hummingbird	*Archilochus alexandri*	native
42650	Anna's Hummingbird	*Calypte anna*	native
42690	Rufous Hummingbird	*Selasphorus rufus*	native
42700	Allen's Hummingbird	*Selasphorus sasin*	native
42710	Belted Kingfisher *	*Ceryle alcyon*	native
42730	Acorn Woodpecker	*Melanerpes formicivorus*	native
42770	Red-breasted Sapsucker	*Sphyrapicus ruber*	native
42780	Nuttall's Woodpecker	*Picoides nuttallii*	native
42790	Downy Woodpecker	*Picoides pubescens*	native
42840	Northern Flicker	*Colaptes auratus*	native
42870	Western Wood-Pewee	*Contopus sordidulus*	native
42890	Willow Flycatcher	*Empidonax traillii*	native
42900	Least Flycatcher	*Empidonax minimus*	native
42910	Hammond's Flycatcher	*Empidonax hammondii*	native
42930	Dusky Flycatcher	*Empidonax oberholseri*	native
42940	Pacific-slope Flycatcher	*Empidonax difficilis*	native
42960	Black Phoebe	*Sayornis nigricans*	native
42980	Say's Phoebe	*Sayornis saya*	native
43000	Ash-throated Flycatcher	*Myiarchus cinerascens*	native
43010	Tropical Kingbird	*Tyrannus melancholicus*	native
43020	Western Kingbird	*Tyrannus verticalis*	native
43060	Loggerhead Shrike	*Lanius ludovicianus*	native
43120	Cassin's Vireo	*Vireo cassinii*	native
43130	Hutton's Vireo	*Vireo huttoni*	native
43140	Warbling Vireo	*Vireo gilvus*	native

43200	Western Scrub-Jay*	*Aphelocoma californica*	native
43240	American Crow*	*Corvus brachyrhynchos*	native
43260	Common Raven *	*Corvus corax*	native
43280	Horned Lark *	*Eremophila alpestris*	native
43290	Purple Martin	*Progne subis*	native
43300	Tree Swallow*	*Tachycineta bicolor*	native
43310	Violet-green Swallow *	*Tachycineta thalassina*	native
43320	Northern Rough-winged Swallow*	*Stelgidopteryx serripennis*	native
43330	Bank Swallow	*Riparia riparia*	native
43340	Cliff Swallow	*Petrochelidon pyrrhonota*	native
43350	Barn Swallow*	*Hirundo rustica*	native
43380	Chestnut-backed Chickadee	*Poecile rufescens*	native
43420	Bushtit	*Psaltriparus minimus*	native
43470	Rock Wren	*Salpinctes obsoletus*	native
43490	Bewick's Wren	*Thryomanes bewickii*	native
43500	House Wren	*Troglodytes aedon*	native
43520	Marsh Wren*	*Cistothorus palustris*	native
43540	Golden-crowned Kinglet	*Regulus satrapa*	native
43530	American Dipper*	*Cinclus mexicanus*	native
43550	Ruby-crowned Kinglet	*Regulus calendula*	native
43560	Blue-gray Gnatcatcher	*Polioptila caerulea*	native
43630	Swainson's Thrush	*Catharus ustulatus*	native
43640	Hermit Thrush	*Catharus guttatus*	native
43660	American Robin *	*Turdus migratorius*	native
43670	Varied Thrush	*Ixoreus naevius*	native
43680	Wrentit	*Chamaea fasciata*	native
43700	Northern Mockingbird *	*Mimus polyglottos*	native
43710	Sage Thrasher	*Oreoscoptes montanus*	native
43770	White Wagtail	*Motacilla alba*	native
43800	American Pipit*	*Anthus rubescens*	native
43820	Cedar Waxwing	*Bombycilla cedrorum*	native

43870	Orange-crowned Warbler	*Vermivora celata*	native
43880	Nashville Warbler	*Vermivora ruficapilla*	native
43920	Yellow Warbler	*Dendroica petechia*	native
43940	Magnolia Warbler	*Dendroica magnolia*	native
43970	Yellow-rumped Warbler	*Dendroica coronata*	native
44000	Townsend's Warbler	*Dendroica townsendi*	native
44060	Palm Warbler	*Dendroica palmarum*	native
44080	Blackpoll Warbler	*Dendroica striata*	native
44100	American Redstart	*Setophaga ruticilla*	native
44140	Northern Waterthrush	*Seiurus noveboracensis*	native
44180	San Francisco common yellowthroat *	*Geothlypis trichas sinuosa*	native
44200	Wilson's Warbler	*Wilsonia pusilla*	native
44220	Yellow-breasted Chat	*Icteria virens*	native
44250	Western Tanager	*Piranga ludoviciana*	native
44270	Spotted Towhee	*Pipilo maculatus*	native
44280	California Towhee	*Pipilo crissalis*	native
44300	Chipping Sparrow	*Spizella passerina*	native
44310	Clay-colored Sparrow	*Spizella pallida*	native
44320	Brewer's Sparrow	*Spizella breweri*	native
44340	Vesper Sparrow	*Pooecetes gramineus*	native
44350	Lark Sparrow	*Chondestes grammacus*	native
44370	Sage Sparrow	*Amphispiza belli*	native
44390	Bryant's savannah sparrow*	*Passerculus sandwichensis alaudinus*	native
44420	Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	native
44430	Fox Sparrow	*Passerella iliaca*	native
44440	Alameda song sparrow*	*Melospiza melodia pusillula*	native
44450	Lincoln's Sparrow	*Melospiza lincolnii*	native
44460	Swamp Sparrow	*Melospiza georgiana*	native
44470	White-throated Sparrow	*Zonotrichia leucophrys*	native
44490	White-crowned Sparrow*	*Zonotrichia atricapilla*	native

44500	Golden-crowned Sparrow*	*Zonotrichia atricapilla*	native
44510	Dark-eyed Junco	*Junco hyemalis*	native
44540	Chestnut-collared Longspur	*Calcarius ornatus*	native
44590	Black-headed Grosbeak	*Pheucticus melanocephalus*	native
44610	Lazuli Bunting	*Passerina amoena*	native
44660	Red-winged Blackbird *	*Agelaius phoeniceus*	native
44670	Tricolored Blackbird*	*Agelaius tricolor*	native
44680	Western Meadowlark*	*Sturnella neglecta*	native
44710	Brewer's Blackbird*	*Euphagus cyanocephalus*	native
44740	Brown-headed Cowbird*	*Molothrus ater*	native
44760	Hooded Oriole	*Icterus cucullatus*	native
44790	Bullock's Oriole	*Icterus bullockii*	native
44870	House Finch	*Carpodacus mexicanus*	native
44920	Pine Siskin	*Spinus pinus*	native
44930	Lesser Goldfinch	*Carduelis psaltria*	native
44950	American Goldfinch*	*Carduelis tristis*	native
50040	Salt marsh wandering shrew	*Sorex vagrans halicoetes*	native
50180	California myotis*	*Myotis californicus*	native
50200	Yuma myotis*	*Myotis yumanensis*	native
50220	Long-legged myotis*	*Myotis volans*	native
50250	Long-eared myotis*	*Myotis septentrionalis*	native
50280	Big brown bat*	*Eptesicus fuscus*	native
50285	Western red bat*	*Lasirurs blossevillii*	native
50290	Hoary bat	*Lasiurus cinereus*	native
50310	Townsend's big-eared bat*	*Corynorhinus townsendii*	native
50320	Northern river otter	*Lontra canadensis*	native
50330	Mexican free-tailed bat	*Tadarida brasiliensis*	native
50360	Brush rabbit	*Sylvilagus bachmani*	native
50381	Desert cottontail	*Sylvilagus audubonii*	native
50420	Black-tailed jackrabbit	*Lepus californicus*	native
50610	California ground squirrel	*Spermophilus beecheyi*	native

50730	Botta's pocket gopher	*Thomomys bottae*	native
50820	Western harvest mouse *	*Reithrodontomys megalotis*	native
50821	Salt marsh harvest mouse*	*Reithrodontomys raviventris raviventris*	native
50830	Deer mouse *	*Peromyscus maniculatus*	native
50890	Dusky-footed woodrat	*Neotoma fuscipes*	native
50990	California vole *	*Microtus californicus*	native
51050	Muskrat *	*Ondatra zibethicus*	native
51180	Gray fox	*Urocyon cinereoargenteus*	native
51220	Raccoon	*Procyon lotor*	native
51260	Long-tailed weasel *	*Mustela frenata*	native
51300	Western spotted skunk	*Spilogale gracilis*	native
51310	Striped skunk *	*Mephitis mephitis*	native
51330	Mountain lion	*Felis concolor*	native
60030	California sea lion*	Zalophus californianus	native
60040	Pacific harbor seal*	*Phoca vitulina richardsi*	native

Appendix A-4 Species Associations with Historic Habitats for without Project Assessment

[Total species listed 205 used to determine higher habitat value level // 171 species used (indicates which species were removed) to determine the lower habitat value level]**

Spp ID	Common Name	Deep Bay / Channel (subtidal)	Dune	Island	Lagoon	Salt Pond	Sandy Beach	Shallow Bay / Channel (intertidal)	Shellflat	Tidal Flat	Tidal Marsh*	**Shell Mounds**
10001	Pacific lamprey	1				1		1	1	1	1	
10071	Sacramento sucker					1					1	
10073	Threespine stickleback	1				1		1	1	1	1	
10081	Prickly sculpin	1				1		1	1	1	1	
10173	Starry flounder	1				1			1	1	1	
10221	Pacific staghorn sculpin	1			1	1	1	1	1	1	1	
10237	Shiner perch	1			1	1		1	1	1	1	
10238	Tule perch	1			1	1		1	1	1	1	
10245	Longfin smelt	1				1		1	1	1	1	
10249	Green sturgeon	1						1	1	1	1	
10295	Steelhead	1						1	1	1	1	
10325	Leopard shark	1						1	1	1	1	
10326	Brown smoothhound	1						1	1	1	1	
10329	Soupfin shark								1	1	1	
10333	Spiny dogfish	1						1	1	1	1	
10337	Big skate	1						1	1	1	1	
10341	California skate	1						1	1	1	1	
10405	Brown rockfish	1			1			1	1	1	1	
10537	English sole	1						1	1	1	1	
10538	California tonguefish	1						1	1	1	1	
10539	Diamond turbot	1						1	1	1	1	
10545	Pacific sanddab								1	1	1	
10561	Sand sole	1						1	1	1	1	

10585	Chinook salmon	1				1		1	1	1	1	
10589	Pink salmon	1				1		1	1	1	1	
10593	Chum salmon	1				1		1	1	1	1	
10628	Longjawed mudsucker	1				1		1			1	
10629	Bay goby	1						1			1	
10633	Arrow goby	1						1			1	
10634	Cheekspot goby	1						1			1	
10637	Speckled sanddab				1				1	1	1	
10641	Pacific herring				1	1			1	1	1	
10648	Barred surfperch	1			1			1	1	1	1	
10653	Surf Smelt					1			1	1	1	
10657	Whitebait smelt	1						1	1	1	1	
10669	Bay pipefish	1				1		1	1	1	1	
10686	Dwarf surfperch	1			1			1	1	1	1	
10729	Plainfin midshipman	1						1	1	1	1	
10757	Topsmelt	1				1		1	1	1	1	
10758	Jack smelt	1				1		1	1	1	1	
10765	Pacific sardine	1						1	1	1	1	
10808	Bat ray	1				1			1	1	1	
10817	Northern anchovy	1				1		1	1	1	1	
11113	White croaker	1						1	1	1	1	
11197	California halibut	1						1	1	1	1	
30100	Southern alligator lizard											1
30160	Western fence lizard											1
30290	Gopher snake										1	1
30320	Western terrestrial garter snake							1			1	1
30340	Common garter snake										1	1
30350	Western rattlesnakes											1
40010	Red-throated Loon	1							1			
40020	Pacific Loon	1							1			

40030	Common Loon	1							1			
40050	Pied-billed Grebe	1			1	1		1	1		1	
40060	Horned Grebe	1				1			1		1	
40070	Red-necked Grebe	1							1			
40080	Eared Grebe	1				1		1	1		1	
40090	Western Grebe	1							1		1	
40100	Clark's Grebe	1							1		1	
40320	American White Pelican			1	1	1			1		1	
40330	Brown Pelican	1			1	1	1		1			
40350	Double-crested Cormorant	1		1		1		1	1	1	1	
40380	American Bittern				1						1	
40390	Least Bittern				1						1	
40400	Great Blue Heron			1	1	1				1	1	1
40410	Great Egret			1	1	1				1	1	
40420	Snowy Egret			1	1	1					1	
40460	Green Heron				1						1	
40470	Black-crowned Night-Heron			1							1	1
40500	Turkey Vulture											1
40530	Greater White-fronted Goose							1			1	
40570	Canada Goose			1	1	1		1			1	
40640	Gadwall				1	1		1			1	
40660	Eurasian Wigeon				1	1		1	1		1	
40670	American Wigeon				1	1		1	1		1	
40690	Mallard			1	1	1		1			1	
40700	Blue-winged Teal				1			1			1	
40710	Cinnamon Teal				1			1			1	
40720	Northern Shoveler				1	1		1			1	
40730	Northern Pintail				1	1		1	1		1	
40760	Green-winged Teal				1	1		1	1		1	
40770	Canvasback	1			1	1		1	1	1	1	

40780	Redhead	1			1	1		1	1	1	1	
40790	Ring-necked Duck	1			1	1		1	1	1	1	
40810	Greater Scaup	1			1	1			1	1	1	
40820	Lesser Scaup	1			1	1			1	1	1	
40860	Surf Scoter	1							1	1	1	
40870	White-winged Scoter	1							1	1	1	
40880	Black Scoter	1							1	1	1	
40890	Long-tailed Duck	1							1	1	1	
40900	Bufflehead	1			1	1			1	1	1	
40910	Common Goldeneye	1			1	1			1	1	1	
40920	Barrow's Goldeneye					1					1	
40940	Hooded Merganser				1				1	1	1	
40950	Common Merganser	1			1				1	1	1	
40960	Red-breasted Merganser				1						1	
40970	Ruddy Duck	1			1	1			1	1	1	
40980	Osprey	1							1	1	1	
40990	White-tailed Kite										1	
41000	Bald Eagle	1		1	1		1				1	1
41010	Northern Harrier					1					1	
41030	Cooper’s Hawk										1	1
41050	Red-shouldered Hawk										1	1
41080	Red-tailed Hawk										1	1
41090	Ferruginous Hawk										1	1
41110	Golden Eagle										1	1
41120	American Kestrel										1	
41130	Merlin										1	
41150	Peregrine Falcon				1		1	1			1	1
41311	California Black Rail										1	
41320	Virginia Rail										1	
41321	California Clapper Rail										1	
41330	Sora				1						1	

41340	Common Moorhen				1						1	
41350	American Coot				1	1		1		1	1	
41370	Black-bellied Plover**				1	1	1		1	1		
41380	American Golden-Plover**		1		1	1	1		1	1		
41390	Pacific Golden-Plover**		1		1	1	1		1	1		
41410	Western Snowy Plover**				1	1	1		1	1		
41420	Semipalmated Plover**		1	1	1	1	1		1	1		
41440	Killdeer **		1	1	1	1	1		1	1	1	
41470	Black Oystercatcher**					1	1		1	1		
41480	Black-necked Stilt**			1	1	1			1	1	1	
41490	American Avocet**			1	1	1			1	1	1	
41500	Greater Yellowlegs**		1	1	1	1			1	1	1	
41510	Lesser Yellowlegs**		1	1	1	1			1	1	1	
41540	Willet**			1	1	1	1		1	1	1	
41550	Wandering Tattler**					1	1		1	1		
41570	Spotted Sandpiper**			1	1	1			1	1	1	
41590	Whimbrel**				1	1			1	1	1	
41610	Long-billed Curlew**			1		1	1		1	1	1	
41640	Marbled Godwit**				1	1	1		1	1	1	
41650	Ruddy Turnstone**		1		1	1	1		1	1	1	
41660	Black Turnstone**				1	1	1		1	1	1	
41670	Surfbird**					1			1	1	1	
41690	Red Knot**				1	1	1		1	1	1	
41700	Sanderling**		1			1	1		1	1	1	
41710	Semipalmated Sandpiper**			1	1	1	1		1	1		
41720	Western Sandpiper**			1	1	1	1		1	1	1	
41760	Least Sandpiper**		1		1	1	1		1	1	1	
41780	Baird’s Sandpiper**		1	1	1	1	1		1	1	1	
41790	Pectoral Sandpiper**			1	1	1			1	1	1	
41800	Sharp-tailed Sandpiper**			1	1	1			1	1		
41820	Dunlin**			1	1	1	1		1	1	1	

41840	Stilt Sandpiper**			1		1			1	1		
41850	Buff-breasted Sandpiper**					1	1		1	1		
41860	Ruff **				1	1			1	1		
41870	Short-billed Dowitcher**			1	1	1	1		1	1	1	
41880	Long-billed Dowitcher**			1	1	1	1		1	1	1	
41890	Wilson's Snipe			1					1		1	
41900	Wilson's Phalarope	1		1		1		1				
41910	Red-necked Phalarope			1	1	1		1			1	
41980	Franklin's Gull			1			1					
42010	Bonaparte's Gull	1	1	1	1		1	1	1	1	1	1
42020	Heermann's Gull		1		1		1		1	1		
42030	Mew Gull	1		1	1		1	1			1	1
42040	Ring-billed Gull	1		1	1		1	1			1	1
42050	California Gull	1		1	1		1	1			1	1
42060	Herring Gull	1		1	1		1	1			1	1
42070	Thayer's Gull	1	1	1	1		1	1			1	1
42100	Western Gull	1	1	1	1		1	1	1	1	1	1
42110	Glaucous-winged Gull	1	1	1	1		1	1	1	1	1	1
42120	Glaucous Gull		1	1	1		1		1	1	1	1
42180	Caspian Tern	1		1	1		1	1	1	1	1	
42190	Elegant Tern						1					
42200	Common Tern	1						1			1	
42210	Arctic Tern						1					
42220	Forster's Tern			1	1			1	1	1	1	
42230	California Least Tern								1	1		
42390	Band-tailed Pigeon						1				1	
42410	Mourning Dove										1	1
42440	Barn Owl					1					1	
42560	Short-eared Owl		1								1	
42710	Belted Kingfisher				1						1	
43200	Western Scrub-Jay										1	1

43280	Horned Lark		1				1					
43300	Tree Swallow										1	
43310	Violet-Green Swallow										1	
43320	Northern Rough-winged Swallow										1	
43350	Barn Swallow		1		1						1	
43520	Marsh Wren										1	
43700	Northern Mockingbird											1
43800	American Pipit										1	
44180	San Francisco common yellowthroat					1					1	
44390	Savannah Sparrow										1	
44440	Alameda song sparrow										1	
44490	White-crowned Sparrow										1	
44660	Red-winged Blackbird										1	
44680	Western Meadowlark										1	
44710	Brewer’s Blackbird											1
50040	Salt marsh wandering shrew										1	
50200	Yuma myotis				1	1		1			1	
50285	Western red bat				1	1						
50290	Hoary Bat					1					1	
50820	Western harvest mouse										1	
50821	Salt marsh harvest mouse										1	
50830	Deer mouse										1	1
50990	California vole										1	1
51050	Muskrat					1					1	
51220	Raccoon		1	1		1	1				1	1
51260	Long-tailed weasel					1					1	
51310	Striped skunk					1					1	1
60030	California sea Lion	1						1				
60040	Pacific harbor seal	1					1	1		1	1	

Appendix A-5 Species Associations with Modern Habitats for without Project Assessment [240 species]

SPP ID	Common Name	Deep Bay / Channel (subtidal)	Dune	Lagoon	Salt Pond	Shallow Bay / Channel (intertidal)	Tidal Flat	Tidal Marsh*	Developed	Agriculture
10001	Pacific lamprey	1				1				
10071	Sacramento sucker									
10073	Threespine stickleback	1			1	1	1	1		
10081	Prickly sculpin	1			1	1	1	1		
10121	Striped bass	1			1	1	1	1		
10149	Common carp				1					
10173	Starry flounder	1						1		
10177	Goldfish				1					
10189	Western mosquito fish				1					
10221	Pacific staghorn sculpin	1		1	1	1	1	1		
10233	American shad	1				1	1			
10234	Threadfin shad	1				1	1			
10237	Shiner perch	1		1	1	1	1	1		
10238	Tule perch	1		1		1	1	1		
10245	Longfin smelt	1				1	1			
10249	Green sturgeon	1				1				
10295	Steelhead	1				1				
10325	Leopard shark	1			1	1	1	1		
10326	Brown smoothhound	1			1	1				
10329	Soupfin shark	1								
10333	Spiny dogfish	1				1				
10337	Big skate	1				1				
10341	California skate	1				1				
10361	Cabezon	1				1				

10405	Brown rockfish	1		1		1	1			
10537	English sole	1				1		1		
10538	California tonguefish	1				1				
10539	Diamond turbot	1			1	1				
10545	Pacific sanddab	1								
10561	Sand sole	1				1				
10585	Chinook salmon	1				1		1		
10589	Pink salmon	1				1				
10593	Chum salmon	1				1				
10628	Longjawed mudsucker				1	1	1	1		
10629	Bay goby					1	1			
10633	Arrow goby					1	1	1		
10634	Cheekspot goby					1				
10637	Speckled sanddab	1		1	1					
10641	Pacific herring	1		1			1	1		
10648	Barred surfperch	1		1	1	1	1	1		
10653	Surf Smelt	1								
10657	Whitebait smelt	1				1				
10669	Bay pipefish	1			1	1		1		
10686	Dwarf surfperch	1		1		1				
10729	Plainfin midshipman	1				1	1			
10757	Topsmelt	1			1	1	1	1		
10758	Jack smelt	1				1	1	1		
10765	Pacific sardine	1				1				
10808	Bat ray	1			1		1	1		
10817	Northern anchovy	1			1	1	1	1		
11113	White croaker	1				1				
11197	California halibut	1				1				
30100	Southern alligator lizard									1
30160	Western fence lizard							1		1
30290	Gopher snake									1

30320	Western terrestrial garter snake							1		1
30340	Common garter snake									1
40010	Red-throated Loon	1								
40020	Pacific Loon	1								
40030	Common Loon	1								
40050	Pied-billed Grebe	1		1	1			1		
40060	Horned Grebe	1			1			1		
40080	Eared Grebe	1			1			1		
40090	Western Grebe	1			1			1		
40100	Clark's Grebe	1			1			1		
40320	American White Pelican	1		1	1			1		
40330	Brown Pelican	1		1	1					
40350	Double-crested Cormorant	1			1			1		
40380	American Bittern					1		1		
40390	Least Bittern					1		1		
40400	Great Blue Heron			1	1	1	1	1		1
40410	Great Egret			1	1	1	1	1		1
40420	Snowy Egret				1	1	1	1		1
40450	Cattle Egret							1		1
40460	Green Heron			1				1		
40470	Black-crowned Night-Heron							1	1	1
40500	Turkey Vulture									1
40530	Greater White-fronted Goose					1		1		1
40570	Canada Goose			1	1	1		1	1	1
40640	Gadwall			1	1	1		1		1
40660	Eurasian Wigeon			1	1	1		1		
40670	American Wigeon			1	1	1		1		1
40690	Mallard			1	1	1		1		1

40700	Blue-winged Teal			1		1		1		1
40710	Cinnamon Teal			1		1		1		
40720	Northern Shoveler			1	1	1		1		
40730	Northern Pintail			1	1	1		1		
40760	Green-winged Teal			1	1	1		1		
40770	Canvasback	1		1	1	1		1		
40780	Redhead	1		1	1			1		
40790	Ring-necked Duck	1			1			1		
40810	Greater Scaup	1			1					
40820	Lesser Scaup	1		1	1					
40860	Surf Scoter	1			1					
40870	White-winged Scoter	1			1					
40880	Black Scoter	1			1					
40890	Long-tailed Duck	1			1					
40900	Bufflehead	1		1	1					
40910	Common Goldeneye	1		1	1					
40920	Barrow’s Goldeneye	1			1					
40940	Hooded Merganser	1		1	1			1		
40950	Common Merganser	1		1	1			1		
40970	Ruddy Duck	1		1	1			1		
40980	Osprey	1						1		
40990	White-tailed Kite							1		
41010	Northern Harrier				1			1		1
41020	Sharp-shinned Hawk								1	
41030	Cooper’s Hawk								1	
41050	Red-shouldered Hawk									1
41080	Red-tailed Hawk									1
41090	Ferruginous Hawk									1
41110	Golden Eagle									1
41120	American Kestrel									1
41130	Merlin									1

41150	Peregrine Falcon			1	1	1		1	1	1
41190	Ring-necked Pheasant									1
41290	California Quail									1
41311	California Black Rail							1		
41320	Virginia Rail							1		
41321	California Clapper rail							1		
41330	Sora			1				1		
41340	Common Moorhen			1				1		
41350	American Coot			1	1	1	1	1		
41370	Black-bellied Plover			1	1		1	1		
41380	American Golden-Plover		1	1	1		1	1		
41410	Western Snowy Plover			1	1		1	1		
41420	Semipalmated Plover		1	1	1		1	1		
41440	Killdeer			1	1		1	1	1	1
41480	Black-necked Stilt			1	1		1	1		
41490	American Avocet			1	1		1	1		
41500	Greater Yellowlegs		1	1	1		1	1		
41510	Lesser Yellowlegs		1	1	1		1	1		
41540	Willet			1	1		1	1		
41570	Spotted Sandpiper			1			1	1		
41590	Whimbrel			1	1		1			
41610	Long-billed Curlew			1	1		1	1		1
41640	Marbled Godwit			1	1		1	1		
41650	Ruddy Turnstone		1	1	1		1	1		
41700	Sanderling		1		1		1			
41710	Semipalmated Sandpiper			1	1		1			
41720	Western Sandpiper			1	1		1	1		
41760	Least Sandpiper		1	1	1		1	1		
41820	Dunlin			1	1		1	1		
41860	Ruff						1	1		
41870	Short-billed Dowitcher			1	1		1	1		

41880	Long-billed Dowitcher			1	1		1	1		
41900	Wilson’s Phalarope	1			1	1				
41910	Red-necked Phalarope	1			1	1				
42010	Bonaparte’s Gull	1	1	1	1			1		
42020	Heermann’s Gull	1	1	1	1			1		
42030	Mew Gull			1	1			1		
42040	Ring-billed Gull			1	1	1		1	1	
42050	California Gull			1	1	1		1	1	
42060	Herring Gull			1	1	1		1		
42070	Thayer’s Gull		1	1	1	1		1		
42100	Western Gull	1	1	1	1	1		1	1	
42110	Glaucous-winged Gull	1	1	1	1			1		
42120	Glaucous Gull	1	1	1	1			1		
42130	Sabine’s Gull				1			1		
42180	Caspian Tern	1			1	1		1		
42201	Black Skimmer	1			1					
42220	Forster’s Tern	1		1	1	1		1		
42230	California Least Tern	1			1	1				
42380	Rock Pigeon								1	1
42390	Band-tailed Pigeon								1	
42410	Mourning Dove								1	1
42440	Barn Owl				1			1		1
42470	Great Horned Owl				1			1		1
42510	Burrowing Owl				1			1		
42560	Short-eared Owl							1		1
42650	Anna’s Hummingbird								1	
42700	Allen’s Hummingbird								1	
42710	Belted Kingfisher							1		
42840	Northern Flicker								1	
42960	Black Phoebe							1	1	
43060	Loggerhead Shrike									1

43200	Western Scrub-Jay								1	
43240	American Crow								1	1
43260	Common Raven								1	1
43280	Horned Lark		1							1
43300	Tree Swallow							1		
43310	Violet-green Swallow							1		
43320	Northern Rough-winged Swallow							1		
43330	Bank Swallow							1		
43340	Cliff Swallow							1		
43350	Barn Swallow		1	1				1		1
43380	Chestnut-backed Chickadee								1	
43420	Bushtit								1	
43490	Bewick’s Wren							1		
43500	House Wren								1	
43520	Marsh Wren							1		
43550	Ruby-crowned Kinglet								1	
43660	American Robin								1	1
43700	Northern Mockingbird								1	
43740	European Starling								1	1
43820	Cedar Waxwing								1	
43970	Yellow-rumped Warbler								1	
44000	Townsend’s Warbler								1	
44180	San Francisco common yellowthroat							1		
44270	Spotted Towhee								1	
44280	California Towhee							1	1	
44390	Bryant's savannah sparrow							1		1
44440	Alameda song sparrow							1		
44490	White-crowned Sparrow							1	1	

44500	Golden-crowned Sparrow							1	1	
44510	Dark-eyed Junco								1	
44660	Red-winged Blackbird							1		1
44670	Tricolored Blackbird							1		1
44680	Western Meadowlark							1		1
44710	Brewer’s Blackbird								1	1
44740	Brown-headed Cowbird									1
44790	Bullock’s Oriole								1	
44870	House Finch								1	1
44970	House Sparrow								1	1
50010	Virginia opossum				1			1	1	1
50035	Ornate Shrew							1		
50040	Salt marsh wandering shrew							1		
50110	Trowbridge's Shrew							1		
50200	Yuma myotis			1	1					
50285	Western red bat			1	1					1
50290	Hoary bat				1					
50330	Mexican free-tailed bat				1					
50420	Black-tailed jackrabbit				1					
50610	California ground squirrel				1					1
50730	Botta's pocket gopher									1
50820	Western harvest mouse							1		1
50821	Salt marsh harvest mouse							1		
50830	Deer mouse									1
50990	California vole							1		1
51050	Common muskrat				1			1		
51070	Black rat								1	
51080	Norway rat				1			1	1	1
51090	House mouse							1	1	1
51160	Red fox				1			1		1

51180	Gray fox				1			1		1
51220	Raccoon		1		1			1	1	1
51260	Long-tailed weasel				1					
51310	Striped skunk				1			1	1	1
60040	Pacific harbor seal	1				1	1	1		

Appendix B

Relationship Matrix Descriptions

MATRIX 1: Potential Species by Function Matrix

The potential species list generated by IBIS (see Appendix A) is aligned with Key Ecological Functions (KEFs) that could potentially be performed in the habitat type and structural condition represented by the polygon. For example, if the polygon represents a "shrub-steppe" habitat type, the KEFs thought to be performed in that habitat type by the potential species are included in the relationship matrix. This information is acquired from IBIS. The result of this matrix is the number of potential species performing key functions in that habitat type. Example follows:

Lowland Mixed Conifer Habitat Type *Species Value (Potential)*	**Function 1** ***Secondary Consumer***	**Function 2** ***Breaks up Down Wood***	**Function 3** ***Primary Excavator***	**Function 4** ***Eats Terrestrial Insects***
Downey Woodpecker	**0**	**1**	**1 (tree)**	**1**
Bobcat	**1**	**0**	**0**	**0**
Belted Kingfisher	**1**	**0**	**1 (burrows)**	**1**
Great Blue Heron	**1**	**0**	**0**	**1**

MATRIX 2: Actual KEC by Function Matrix

In this matrix, the functions, or KEFs, are again related to Key Environmental Correlates (KECs), but this time the KECs are those actually present at the site (based on field data inventory). Because this is an actual account, those KEFs not correlated to an actual KEC are then removed. The result of this matrix is the number of KEFs characterized by KECs specific to that polygon. Example follows:

Lowland Mixed Conifer Habitat Type *KEC Value (Potential)*	**Function 1** ***Creates Snags***	**Function 2** ***Breaks up Down Wood***	**Function 3** ***Primary Excavator***	**Function 4** ***Eats Terrestrial Insects***
KEC 1 down wood	**0**	**1**	**0**	**1**
KEC 2 snags	**1**	**0**	**1**	**1**
KEC 3 tree cavities	**1**	**1**	**1**	**1**
KEC 4 hollow living trees	**0**	**1**	**0**	**1**